

ENGINEERING DESIGN MANUAL  
RETURN TO

# KNIGHTVILLE DAM

HUNTINGTON, MASSACHUSETTS

## OPERATION AND MAINTENANCE MANUAL



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RETURN TO



DEPARTMENT OF THE ARMY  
NEW ENGLAND DIVISION, CORPS OF ENGINEERS  
WALTHAM, MASS.

JUNE 1972

OPERATION AND MAINTENANCE MANUAL  
FOR  
KNIGHTVILLE DAM, MASSACHUSETTS

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DEPARTMENT OF THE ARMY  
NEW ENGLAND DIVISION, CORPS OF ENGINEERS  
424 Trapelo Road  
Waltham, Massachusetts 02154

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## OPERATION AND MAINTENANCE MANUAL

### PART I - GENERAL

#### CHAPTER 1 - INTRODUCTION:

a. Authority: Project Operation Manual Regulation ER1130-2-304 and Appendix I dated 25 March 1966.

b. Purpose: The purpose of the manual is to provide guidance and instruction to the project personnel for the proper operation and maintenance of the project facilities.

c. Parts of Manual:

Part I	General
Part II	Operation and Maintenance

d. Scope of Manual: The scope of the manual is limited to the essential operation and maintenance instructions to the operating personnel for the proper upkeep, repair, maintenance and operation of the project facilities.

#### CHAPTER 2 - PROJECT DESCRIPTION:

a. Authorization and Location: The Knightville reservoir project is a unit of a comprehensive plan for flood control and other purposes in Connecticut River Basin which was authorized by the Flood Control Acts of June 22, 1936, as amended, and June 28, 1938 (House Document 455, 75th Congress, 2nd session).

The dam is on the Westfield River, 27.5 miles above its junction with the Connecticut River. It is 4 miles north of the town of Huntington, Massachusetts, and about 12 miles west of city of Northampton, Massachusetts.

b. Brief Description of Project: The dam is a hydraulic earthfill type with a dumped rock shell and a downstream rock toe. It has a top length of 1,200 feet, a top width of 30 feet, and is 160 feet above riverbed. The spillway is a curved concrete weir 410 feet long, on rock in a saddle at the right end of the dam. Outlet works are in the right abutment and consist of an intake channel 280 feet long and a 16-foot diameter tunnel through rock. Tunnel is 605 long and controlled by three 6- by 12-foot broome gates mechanically operated through a control tower from a gatehouse above. Reservoir is now operated for flood control purposes and has a storage capacity of 49,000 acre-feet, equivalent to 5.6 inches of runoff from its drainage area of 162 square miles.

PERTINENT DATA

RIVER BASIN: Connecticut  
PROJECT NAME: Knightville Dam  
RIVER: Westfield River  
LOCATION: Huntington, Mass.

DRAINAGE AREA SQ. MILES: 162

RESERVOIR

Permanent Pool No Permanent Pool

FLOOD CONTROL STORAGE

Capacity - Acre Feet 49,000  
- Inches of Runoff 5.6  
Area at Crest - Acres 960  
Length - Miles 6

DAM

Type Hydraulic earthfill  
Length - feet 1,200  
Top elev. ft. - m.s.l. 630  
Height above river bed 160

DIKES - Number, Total Length None

SPILLWAY

Type Chute Spillway  
Length - feet Ogee Weir  
Elev. - m.s.l. 400  
Distance below to top of Dam - feet 610  
Area at Crest 20  
960

CONTROL WORKS

Type Tunnel

Size - feet 16' Diameter  
Length - feet 605  
Invert elev. - m.s.l. 480  
Capacity - full pool - c.f.s. 14,400  
Gates - Type Broome  
Number 3  
Size 6' x 12'

TOTAL QUANTITIES

Embankment Volume - c.y. 1,240,000  
Concrete - c.y. 46,000

TOTAL COST \$3,310,000

OPERATIONAL DATA December 1941

PROJECT AREA - Fee (Acres)  
                    Easement (Acres)

2,430  
258

RECREATIONAL FACILITIES

11 picnic tables,  
8 fireplaces, 2 parking  
areas, 1 comfort station,  
drinking water supply

Managed by:

CofE and Mass. Div. of  
Fisheries and Game

NO. OF PERMANENT EMPLOYEES:

2

RADIO CALL SIGN:

WUA 25

RIVER STAGE CHECKPOINTS AT:

None

NO. OF GOV'T QUARTERS:

1



c. History: Pertinent Data: (1) Work was started on the project September 1939 and completed December 1941. Construction cost for the completed project was \$2,399,200.

(2) The utility building and operator's quarters was constructed by the Government in 1950.

(3) Repairs to walls and roof of Gate House initiated in 1959, completed in 1961, additional repairs in 1967.

(4) The bridge was repainted in 1949 and in 1968 by contract; touch-up at other times by dam operator.

(5) Road repairs were performed in 1962, 1965 and 1972.

d. List of Project Contracts:

(1) Knightville Dam was constructed by Geo. M. Brewster & Sons Inc., Dec. 1941, Contract W-699-ENG-848.

(2) Repainting service bridge by Greenwood & Co., Contract No. CIVENG49-68.

(3) Construction of utility building by C.M. Bacon & Sons 1950, Contract No. DA19-016-ENG-356.

(4) Fencing property by Anchor Post Products Inc. in 1958, Contract No. 58-50.

(5) Repairs to walls and roof of gate house. Contract No. DA-19-016-CIVENG-59-111, 1960 by South Shore Waterproofing Co.

(6) Resurfacing access road by Osley Construction Co., Contract No. CIVENG62-319. Work performed in 1962.

(7) Resurface road on dam by Warner Bros. Inc. in 1965, Contract No. 65-229.

(8) Repairs to service bridge in 1965, Contract No. CIVENG65-231.

(9) Repairs to intake house in 1967.

(10) Painting bridge in 1968 by Hudson Maintenance Co., Contract No. C-0017.

(11) Repairs to electrical facilities in 1967 by Frueau Electrical Cont. Co., Contract No. 66-50.

(12) Electrical and signal service relocation by Valley Electric and Heating Service, Inc. in 1970, Contract No. 69-C-0026.

(13) Repairing and resurfacing of roads, spring and summer of 1972 by Warner Bros. Inc., Contract No. DACW33-72-C-0062.

## PART II - OPERATION AND MAINTENANCE

### CHAPTER 1 - GENERAL

a. Scope. Part II of the manual covers the operating and maintenance instructions, limits, and criteria for only the major or critical project equipment and facilities and only information actually needed for the guidance of the dam operator and others concerned with the operation and maintenance of Knightville Dam, Westfield River, Massachusetts, by trained operating personnel. Information that is obvious for association with project equipment or available from maintenance manuals is not included. Chapter 1 is the introduction of Part II of the manual and includes miscellaneous items and supplementary information and requirements not included elsewhere.

b. Maintenance. (1) Inasmuch as mechanical and electrical equipment deteriorates more rapidly from idleness than continued use, all such equipment and facilities require periodic operation at frequent intervals. Periodic operation of equipment permits an inspection of the functioning of all parts so that defective ones may be replaced or repaired before their use is required for project operations. The performance of complete periodic maintenance routines is outlined in later chapters of this manual and in the appropriate maintenance manual for each piece of equipment will insure that the equipment is in proper running order at all times.

(2) Maintenance standards for the dam and reservoir not specifically covered in this manual will be consistent with objectives set forth in ER 1130-2-400 and the criteria established for recreation facilities in EM 1130-2-312. Facilities will be maintained at a standard that provides adequate protection for the health and safety of the public and shall meet and may exceed the health and sanitation laws of the State, county or city in which the project is located.

c. Safety. The head dam operator and his assistants shall be familiar with Corps of Engineers Safety Manual "General Safety Requirements" (EM 385-1-1 dated 1 March 1967) and shall comply with all applicable provisions.

d. Regulation Procedures. The Reservoir Control Center, Engineering Division, is responsible for regulation of flood control reservoirs. These procedures are included in the Connecticut River Basin Master Manual of Reservoir Regulation, Appendix H. The operation and maintenance of all hydrologic instruments is included under the regulation manual.

e. Supervisory Responsibilities. The Head Dam Operator will, in general, be supervising from one to several employees. He must

make sure that all employees know just what is expected of them and must see that all employees carry out their duties in a workmanlike manner.

The Head Dam Operator will plan all the work for his employees ahead of time and procure all necessary materials and equipment so that when employees get through one job they can be instantly assigned to another job. Work schedules should be set up so that work items can be completed as work conditions allow.

A good supervisor will so plan his work that one job works in well with another.

The work should be scheduled during the year so that the work to be accomplished inside of buildings may be performed in the winter months.

In the summer, the Head Dam Operator will have a list of projects planned, both for outdoor work and indoor work. The rules and instructions set forth in this manual are for assuring that the Head Dam Operator will have the equipment and dam in such condition that it will always be ready for emergency operation.

f. Leave. The Reservoir Manager shall be advised in advance whenever the Head Dam Operator will be absent overnight from the dam or from his home. Extended annual leave will be requested from his Reservoir Manager. In event of emergency leave, telephone or radio contact shall be made with the Reservoir Manager. In all instances, the assistant dam operator will be advised the detailed information as to his location and method of contact.

g. Public Relations. Dam operators should always bear in mind that they are representing the Corps of Engineers, U. S. Army, and that people within a radius of many miles think of him in that capacity. He must be diplomatic and careful in his statements, or he will find that observations lightly or facetiously made, are given disproportionate weight and publicity, very much to his embarrassment and that of the Division.

Dam operators are to be pleasant and courteous in their dealings with the public. They are expected to know, generally, the reasons for the main features of the dam, what purpose they serve and why they were so constructed. Dam operators are not expected to maintain "open house" all the time at the dam to show visitors around. However, if representative groups wish to arrange to inspect the structures, the dam operators should accompany them. If public officials or visitors having more than a curious interest visit the dam, the dam

operator will conduct them over the project and explain as much as possible the functions of the dam. He should take pride in his job, for it is a responsible one, and in his organization; the result will be public confidence in him, the structure and the organization.

Owners of adjacent property and riparian residents who may be affected by reservoir operations should be treated in a friendly and tactful manner. Proper questions should be civilly and reasonably answered. We have nothing to hide. Explanations should be made in manner and detail as to preclude misunderstanding and subsequent criticism. Forecasting of river stages or crests or extent of damages shall be avoided. River stage forecasting is the responsibility of the U.S. Weather Service, therefore, particular care must be exercised that comments are not construed to be river stage predictions.

h. Real Estate Outgrant Administration. The Head Dam Operator will forward with his comments any inquiries for outgrants to the Reservoir Manager. He will monitor all existing outgrants and report all irregularities to the Reservoir Manager.

i. Summary of Service Duties

(1) Daily

- (a) Water surface reading from water level recorder.
- (b) Precipitation reading from rain gage.
- (c) Read and record thermometer values.
- (d) Record weather observations on U.S.W.S. Form E14 and Form 612-14.
- (e) Clean rest and toilet rooms.
- (f) During period of flood flow check operation of all remote recorders and telemarks.

(2) Weekly

- (a) Operate standby unit up to operating temperature to provide power for tests.
- (b) Test traveling crane.
- (c) Change rain gage and weekly pool elevation charts.
- (d) During periods of normal flows, check remote recorders and telemarks.
- (e) Clean gatehouse.

(3) Monthly

- (a) Inspect reservoir area.
- (b) Inspect battery and air filter on standby unit.
- (c) Inspect power and telephone lines.
- (d) Change monthly pool elevation chart and rain gage tape.
- (e) Operate engine-generator unit for two hours.

(4) Every Six Months

- (a) Inspect gatehouse.
- (b) Check all concrete structures.
- (c) Change crankcase oil in standby unit.
- (d) Inspect foundation drains May and November.

(5) Annually

- (a) Check seal of gate when pool is drained.
- (b) Oil bearings and worm gear in floorstand limit switch.
- (c) Winter change rain gage.
- (d) Check condition of anti-freeze each fall in all diesel and gasoline engines and install new or additional as required.
- (e) Inspect and test life preserver vests.
- (f) Inventory of property.

j. Reports

- (1) Daily Log. A daily log or record book will be maintained by the Dam Operator. Entries should be made daily and should include notes of all activities outside of normal routine. The entries should be complete and should

provide a record of all consequential events concerning the dam and reservoir area, daily 8 a.m. pool and outflow readings.

- (2) Weekly gate operation and pool elevation report NED Form 90.
- (3) Monthly report of maintenance.
- (4) Monthly receiving report for electrical and telephone service.
- (5) Safety report ENG 1600.
- (6) Monthly climatological report WB Form 612.14.
- (7) Snow course reports as required.
- (8) Flood control observations after each operation for flood control.
- (9) Weekly hydrology report NED Form 477.
- (10) Daily river and rainfall report E 14.
- (11) Monthly visitation data NED 545.
- (12) Weekly motor vehicle trip ticket NED 614.
- (13) Record of purchases monthly NED 236.
- (14) Quarterly fuel consumption report.

With the exception of "Daily Log" the above-listed reports and records are submitted on prepared forms which are self-explanatory.

k. Recommended List of Spare Parts and Firefighting Equipment.

Spare Parts. Each dam should have as a minimum a store of the following spare parts. An expeditious local source of supply of spare parts will suffice in lieu of storage of spare parts at the project.

- (1) Electric Generator Unit. (Per Unit).
  - (a) Engine, Diesel
    1. Fuel pump
    2. Two fuel injector nozzles

3. Fan belt
4. Two exhaust valves
5. Four valve springs (four-cycle only)
6. Two intake valves (four-cycle only)
7. Head gasket
8. Complete set of manifold gaskets
9. Fuel filter
10. Oil filter

(b) Generator.

1. Set of brushes for exciter
2. Set of brushes for generator field
3. Two springs for exciter brushes
4. Two springs for generator field brushes

(2) Gate Hoists.

1. Two coils for motor starters
2. Six sets of contacts for motor starters

(3) Crane.

1. Set of brushes for wound rotor motor
2. Spare set of contacts for each magnetic starter
3. Spare coil for each motor starter

(4) Electrical.

1. Twelve fuses for every size used on job
2. 100 ft. of No. 12-600 volt wire, 2-conductor
3. Two rolls rubber tape
4. Two rolls friction tape
5. Spare floodlight bulbs
6. Fuse puller

(5) Firefighting Equipment. The dam that has a portable fire pump will keep the following standard equipment complement, stored in an easily accessible place, along with the pumper.

1. 10 batteries, flashlight
2. 1 small tool box
3. 1 oil can, squirt
4. 1 five-gallon can, Protectoseal, Underwriters Laboratories approved, filled with four gallons of regular gasoline
5. 1 pump backpack carrier
6. 2 starting cords
7. 2 flashlights
8. 1 2-in oil funnel
9. 1 screened funnel
10. 50 hose gaskets, 1-1/2"
11. 1 one-pound can of cup grease
12. 1 peen hammer
13. 2 flexible gasoline hoses
14. 2,000 feet of 1-1/2" linen hose
15. 50 feet of 1-1/2" suction hose
16. 2 eight-foot lengths of 1-1/2" suction hose
17. 1 first aid kit, filler only
18. 1 pint oil measure
19. 2 nozzles, 1-1/2" (1 adjustable fog & 1 combination)
20. 6 quarts of oil (outboard motor oil SAE 30) in cans
21. 1 oil can opener



22. 1 galvanized pail
23. 1 pair of adjustable pliers
24. 2 pounds of rags
25. 1 screwdriver
26. 2 sets of sparkplugs (extra)
27. 1 suction strainer, 1-1/2" (disc type)
28. 1 5-gallon gasoline tank (empty)
29. 2 rolls friction tape
30. 1 check and bleeder automatic valve
31. 1 pressure relief valve (this may be in combination with the automatic check valve)
32. 2 bleeder valves
33. 1 Siamese valve
34. 2 Wescott type wrenches
35. 1 set of ignition wrenches
36. 1 pump wrench
37. 1 sparkplug wrench
38. 2 spanner wrenches

(6) All other spare parts recommended by manufacturer's manuals.

1. Listing of Drawings. The following drawings cover the major items covered under this manual. Those indicated by asterisk are inserted at the end of Part II of the manual.

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Subsurface Explorations	CT-2-1060
Photostats of Topography	

m. Equipment and Shop Drawing Files. This manual does not include operating and maintenance instructions and other maintenance information which are covered or included in the equipment and drawing files of the dam operator. These files include operating manuals, design memorandum, shop drawings of equipment, catalog cut and maintenance instructions, and other supplementary information. The items on file are as follows:

## (1) Manuals.

- (a) Gate Hoists - Instructions relating to Maintenance of the Gate and Hoisting Equipment for the Knightville Dam, Huntington, Mass. Furnished by Philips & Davies, Inc., Kenton, Ohio.
- (b) Shaw Box Crane - Spare Parts Catalog and descriptive data concerning Shaw-Box Crane. (Shop prints included)
- (c) Emergency Generator - Instruction Book and Parts List concerning Hercules Diesel.

(2) Shop Drawings.

<u>Sheet No.</u>	<u>Title</u>	<u>Dwg. No.</u>
	Concrete Monoliths - Spillway Weir	KD-17-2
	General Layout - Kn Dam	KD-B11 & KD-B12
	Concrete Monoliths - Outlet	KD-15
	Concrete Monoliths - Spillway Weir	KD-17
	Toe Wall Railing Details	KD-37
	Misc. Steel Details - Control House Contract #A-1241	
2	Service Bridge - Girders	
E1	Service Bridge - Masonry Plan	
E2	Service Bridge - Erection Diagram	
1	Service Bridge - Pedestals	
4	Service Bridge - End Dams	
	Assembly 75-ton Hoist	O-7420
	Lifting Beam Assembly	O-7425

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## CHAPTER 2 - DAM

a. Slopes and Gutters. (1) Slopes (Cover Rock, Gravel, Grass). The slopes of the dam, including those protected by rock or gravel, must be carefully watched for settlement or erosion. Slopes shall be kept free of debris; rock and gravel slopes shall be kept free of vegetation.

(2) Burrowing animals constitute a hazard to any embankment. Although there is little probability of rodent holes beneath a rock fill which is bedded on gravel, the dam operator should watch for rodents around the slopes and destroy them by poison and traps. Gravel slopes shall be maintained in a smooth even plane.

(3) Protection Stone. Protection stone of all types shall be kept free from debris and vegetation; dislodged stones must be promptly replaced.

(4) Grassed Slopes. Periodic inspections shall be made of all grassed slopes and other grassed areas to note subsidences, slides, erosions, etc. Corrective action in the form of drains, pervious blankets, etc., will be directed by the Operations Division when the failures or incipient failures are of substantial magnitude. All grassed areas shall be mowed at least once a year. On many areas it will be necessary to mow two or more times a year to keep up the appearance and discourage the growth of weeds. When necessary to reestablish turf, the seeding operations will start at the earliest practicable date in the spring or fall to obtain the greatest possible protection against erosion. Areas requiring seeding shall be dressed to proper grade, and irregularities in the surface removed. The surface should then be raked or harrowed parallel to the contour of the slope (never up and down) to a depth of three-quarters of an inch. Debris shall always be removed promptly; deposits of debris are unsightly, detrimental to the growth of grass and encourage the nesting of rats and other burrowing animals.

(5) Gutters. These shall be kept in effective condition with displaced rock promptly replaced. Principal hazard is from erosion at edges, caused by flows beyond the capacity of the gutter or by blockage. Failure is progressive and rapid.

(6) Observations shall be made for potentials for major rock falls or slides in spillway and outlet works where blockage may result. Report such potential falls promptly to Operations Division and Reservoir Manager.

(7) Embankments and Fills. Visual observation by employees working on or near embankment fills for erosion, slides, settlement, springs, boils and other unusual conditions. Close inspection yearly of embankments

and fills to detect leaks, settlement, excessive erosion, and slides. The embankment and fills should be maintained to original grade and alignment. Repair depressions or washes that might tend to weaken the embankment or fill.

b. Observation Wells and Piezometer Tubes. (1) Observation Wells. Inspect and test in accordance with schedule and instructions established.

(2) Piezometer Tubes. Check annually for deterioration of paint and pipes. Touch-up and repaint as necessary. Replace pipe sections as necessary.

c. Inspection During Floods. (1) The behavior of the dam during floods is of vital importance and interest. Periods of storage are the times of danger and, if weaknesses develop, it is essential that they be noted and prompt corrective action taken. The dam operator must recognize that a condition which is of minor importance with a relatively low head may assume serious proportions with increasing pool levels, and he must be constantly alert to note and report even minor failures or changes in the conditions of the embankment. Results of a single careful inspection of the embankment during a flood can be more significant and valuable than a great number of equally careful inspections when the embankment is not impounding water.

(2) When the reservoir is filling or is storing water, the dam operator will inspect the exposed faces of the dam with particular attention to the downstream face, the dam abutments and the area adjacent to downstream face of dam for "springs", sand boils, subsidences, sloughing of embankment or abutments, or other indication of leakage through, around or under the dam. Any evidence of increased flow from new "springs" or the movement of soil particles shall be immediately reported.

(3) When the reservoir is being drawn down, the dam operator will inspect the exposed faces of the dam, with particular attention to the upstream face and abutments for slides or indications of incipient slides. The dam operator will also observe if there is any sloughing of banks in reservoir areas. On the dam proper, the guard rails on top of the dam, if well aligned, will provide a means to detect lateral movement of the dam top that may precede a slide. Any evidence of slides or incipient slides shall be reported immediately.

(4) During the first filling of the reservoir, and each time the reservoir is filled to a higher level than previously experienced, inspection of the downstream area shall be particularly detailed and conducted at least twice daily during storage and at least three times weekly during drawdown until two weeks after completion of drawdown. During subsequent filling, storage and drawdown periods, inspections of the embankment may be conducted less frequently but when above El. 450, never less than once a day during filling and storage and during drawdown.



CHAPTER 3 - INTAKE AND OUTLET WORKS, RETAINING WALLS,  
BUILDINGS, BRIDGES AND SPILLWAY

a. Concrete and Masonry and Exterior Surfaces - General. (1) Visual inspection by employees working on or near the dam to detect cracks, leaks, collection of ice or heaving of slabs; movement and misalignment of walls, debris formation, displacements, offsets at joints, or other irregularities. A close and more complete inspection to detect cracks, leaks, spalling, and deterioration of concrete or masonry will be made semi-annually. Normally, concrete and masonry structures required only limited maintenance; however, when failures occur, report conditions to Reservoir Manager so that timely repairs can be made by others in order to prevent serious damage requiring replacement or costly repairs.

(2) Expansion Joints. Visually inspect annually for signs of leaks, defective joint material or faulty water stops. Clean joints and fill with filler as required. Report required repairs as necessary.

(3) Concrete. The concrete structures shall be carefully inspected at intervals of six months and after each major filling operation. In addition, tunnel shall have interior carefully inspected at least once every two years. The inspection shall include a survey of the general conditions of the concrete surfaces, noting location and extent of cracks, crazing and spalling, and other type of deterioration or disintegration that may have developed, the accumulation of debris, and other unusual conditions. Surfaces adjacent to cracks shall be inspected for differential movement; similar inspections shall be made of construction and expansion joints. Any point or points of leakage will be noted and the condition of all water passages inspected for evidence of erosion or cavitation. The exposed portion of embedded items and the concrete adjacent thereto shall be carefully inspected. All drain holes shall be cleaned. Any condition requiring or suspected to require corrective action shall be brought to the attention of the Operations Division immediately. The inspection shall be made a matter of record with report submitted to Operations Division, including a sketch showing the location and nature of the defects. All accumulated debris shall be removed at spillway, outlet structure, channels, etc.

(4) Exterior Surfaces. Visually inspect all surfaces annually (except as otherwise stated) to discover cracks, damaged finishes, broken block or brick, faulty joints, missing, warped, or defective siding; check around all openings for cracks and leaks; check metal siding for loose nails, defective siding; check around all openings for cracks and leaks; check metal siding for loose nails, defective gaskets or fastenings. It should be noted that exterior surfaces of intake structure will

be made semi-annually. Dam operator shall repair and replace damaged surfaces to the extent of his ability; report conditions not considered repairable by dam operator to the Reservoir Manager.

b. Retaining Walls. (1) In cases where the slopes are confined by a retaining wall, the wall shall be normally inspected every two years except inspection shall be made daily when the pool level is equal to half the height of the dam. Any movement, cracks or seepages through or around the wall must be noted and promptly reported.

(2) Irregularities such as stress cracks, settlement, tilting, erosion along top of wall, clogged weep holes, deterioration of wall material, displacement, and undercutting of foundation. Provide good drainage to prevent erosion and scouring at the base and top. Keep weep holes open.

c. Trash Racks. When the flow through the trash racks is at a minimum, trash racks shall be inspected and painted as required. All debris collecting at the racks shall be removed after each operation involving storage of water by removing them from the intake channel by boat or otherwise.

d. Log Booms. The log booms will be inspected monthly for broken logs or evidence of rot near holes that contain the ends of the boom chains, and for damaged cables or chains. When operating during large inflows into the reservoir or when ice is in the river, the log boom will be under stress and must be at full strength at all times. Logs not floating will be placed on concrete blocks to keep them off the ground. Spare boom logs shall be available and shall be stored off the ground. All debris collecting behind log booms shall be removed during inspection and especially after large inflows into the reservoir.

e. Tile Gages. Clean the tile gages regularly to facilitate reading. When cleaning the gages, check for cracking, spalling, or abrasion, and insure that gages are securely in place.

f. Buildings. (1) Roofing and Flashing. Close inspection shall be performed semi-annually to detect leaks, loose or missing shingles, blisters, weathered built-up roofing, displacement of gravel, damaged ridge or valley coverings; particularly check plastic flashings at vents, and vertical intersections of roof; check metal flashings and counter flashings for loose seams rusting or galvanic action. Following heavy rains or severe storms check roofing and flashings for leaks, missing or damaged shingles or other damage.

The secret of trouble-free low-cost maintenance is a regular resaturation of the membranes or plies of felt while it is still sound. Gravel or slag surfaced roofs need only spot resaturation where the membrane has become exposed, replacing gravel over the resaturated area. Open up large blisters and repair to protect underlying plies. Keep roof drains open and roof well drained. Indication of water under membrane

should be thoroughly investigated to locate the source and repair immediately. Investigate all cracks or other defects and if more than a single ply is affected, repairs should be made promptly.

(2) Floors. Examine annually floors (concrete) for cracks, settlement, scaling, dusting, pitting and deterioration; (wood) buckling, splintering, loose boards, sagging, loose or missing covering materials; asphalt, quarry, ceramic and vinyl tile floors for condition.

(3) Railings and Metal Work. (a) All metal work on equipment, gratings, railings, ladders, etc., shall be kept neatly painted. Windows shall be kept well flashed. Front entrance doors shall be examined, particularly on the top, for holes. The metal doors shall be completely sealed to prevent the entrance of moisture which would corrode the door from the inside. All holes shall be promptly sealed. Changes in color shall not be made without prior approval.

(b) Examine supports, treads, railings, grating, anchors and bolts for rust, deterioration and rigidity every two years.

(c) In order to assure that maintenance is adequate and timely, performance of the following is essential:

Tighten all loose bolts and anchorage items.

Repair all broken welds and defective members.

Replace worn or slippery treads.

Keep all stairways, landings and catwalks cleaned of debris, free of obstructions, grease, and oil and keep hand railing rigid and well secured to base.

Replace broken catch basin and manhole covers promptly.

(4) Windows, Doors and Screens. Once each year, check weather stripping, calking around framing, stops, door closers, locks, latches, screens, glazing, hinges and stiles. Following heavy rains or severe storms make an inspection to determine extent of damage to windows and doors. Replace broken glass promptly.

(5) Wood framing and sheathing. Every two years, check for dry rot, loose or missing boards or shingles, warped, checking, settlement, leaks, or other irregularities. Make close inspection of floor joists, sills and beams for termite damage.

Maintain sufficient ventilation under floor areas to dispel moisture and undesirable odors. Replace or reinforce defective material and treat for termites as necessary.

(6) Gutters and Downspouts. Inspect condition, every two years, of fixed and slip joints, check gutter hangers, and spacers for adequacy, tightness, alignment, rust, deterioration, clogged strainers or downspouts, leaves or debris.

(7) Interior Walls and Ceilings. Close inspection every two years to detect cracks in plaster, water stains, deteriorated plaster, broken or damaged tile, mildew, broken or damaged wall board or paneling, disfiguration or other damage.

(8) Insect Control. Insects shall be disposed of by periodic spraying and/or treatment.

(9) Stairways, Wood. Check condition, every two years, of treads, handrails, and anchorage for wear, deterioration and safety conditions.

g. Bridges. Bridges will be inspected periodically by Engineering Personnel to determine the condition of the bridge and to note evidences of damage or incipient failure. Periodically, bridges will be completely repainted either by contract or by hired labor.

## CHAPTER 4 - UTILITIES

a. Water Supply and Sewer Systems. (1) Observe component of each system weekly for good condition and proper operation in connection with water wells, distribution lines, treatment facilities, etc.

Every year the above systems shall be closely inspected for good condition and proper operations. Drain and clean systems thoroughly, as applicable, to insure satisfactory operation. All pneumatic and gravity storage tanks come under the above requirement.

(2) Potable Water Tests. All water treated by the dam operator shall be tested semi-annually for chlorine content. Send sample of water for analysis as required by State or local authority. Where there are no local or State requirements, water shall be analyzed at least semi-annually.

(3) Piping. When in the area of piping, observe for indications of leaks. Where possible examine systems for leaks, excessive corrosion or other damage annually. Inspect pipe covering or coating where provided. Repair or replace piping, covering or coating as needed to maintain good condition. Clean piping system as necessary. Check piping system identifying markers, clean and replace as required.

(4) Valves. When in the area of valves, observe for indications of leaking valve stem, flanges or connections. Inspect valves for leaks and general condition annually. Renew packing if needed. Reseat or replace valve and tighten connections as required. Be sure valve is left in normal operating position.

(5) Plumbing systems. Check annually plumbing fixtures and exposed pipe and pipe covering for leaks, malfunctioning and damage. Check relief valves of hot water tanks.

(6) Sewer systems. Inspect annually grease traps, fixture traps, discharge lines, septic tanks and leaching fields for proper functioning and leaks.

(7) Water well. Check top of casing semi-annually for damage which will permit surface water to enter, check hand-type pumps for damage or malfunction, drain before freezing weather.

Water from wells or other sources provided for human consumption shall meet State and local requirements. Water tests will be made as required by the State health agency and in a manner approved by that agency. Contaminated wells will be closed to public use. Well will be capped and maintained in a manner to preclude contamination from surface run-off.

b. Heating and Ventilating. (1) General. Observe for proper operation.

(2) Duct Systems. Check duct system for general over-all condition once a year. Tighten loose connections and supports as needed. On systems using oil-type air filters be sure that oil vapor is not being carried over into duct system. Clean system as required to maintain good condition.

(3) Louvers and Dampers. Observe louvers and dampers for proper functioning and good condition. Adjust, repair and clean annually or as necessary for good operation.

(4) Air filters. Observe air filters bi-monthly for good condition and proper operation. Replace dirty filters.

(5) Heating and Ventilating Fans. Observe belt drives semi-annually for condition and satisfactory operation. Repair and clean fans as necessary to maintain good operating condition.

(6) Plenum chambers. Observe condition of plenum chambers. Inspect doors for good seals and latches. Repair, adjust and clean as needed.

(7) Heating and Ventilating Controls. Examine all thermostats, step controllers, contactors, etc., annually to determine items are in good condition and operating satisfactorily. Adjust or repair as needed to provide proper operation.

(8) Heating System (Forced Warm Air). Prior to the heating season, preferably during summer months, the heating unit shall have a complete check up and cleaning by a qualified oil burner service company. This shall include a complete cleaning of the furnace and oil burner. The oil burner shall be adjusted for proper combustion, electrode setting checked, firing rate and nozzle angle noted, draft regulation adjusted for proper draft over the fire and at the breeching, condition of the combustion chamber noted, stack, fan and limit switches checked, fuel oil filter cleaned or replaced. A complete combustion and efficiency test shall be performed and all data recorded for record. Combustion Test Data Sheet shall be used. Check and oil forced-air-fan and motor. Clean fan blades as needed. Check fan belt tension, tighten same and/or replace same if necessary. Clean or replace air filters as necessary. Check thermostat for satisfactory operation and general condition. Inspect chimney flue, clean out debris as necessary.

(9) Boilers, Steam and Hot Water. At the end of the heating season drain and flush boiler and refill. Prior to the heating season, preferably during the summer months, the heating unit shall have a check up and cleaning by a qualified oil burner service company. This shall include a complete cleaning of the boiler and oil burner. The oil burner shall be adjusted for proper combustion, electrode setting checked, firing rate and nozzle angle noted, draft regulation adjusted for proper draft over the fire and at the breeching, condition of the combustion chamber noted, stack, pressure and high limit operating controls checked, fuel oil filter cleaned or replaced. A complete combustion and efficiency test shall be performed and all data recorded for record. Combustion Test Data Sheet shall be used. Check condensate pump and control. Check hot water circulator pump and circulator control. Check hot water circulator pump oil sump and oil as required. Check thermostat for satisfactory operation and general condition. Inspect chimney flue, clean out debris as necessary.

c. Telephone and Radio Equipment. (1) Exterior Telephone Equipment. Observe condition of poles, insulators, pins, hardware, cable messengers, telephone cables and wires, terminal boxes, protectors, etc. Report unsatisfactory condition to Utility Company.

(2) Radio Equipment. During normal project use, observe that equipment is functioning properly. Check condition of antenna and report any required repairs as necessary. Observe conditions of lead-in conductors; report any damage as necessary. See that components of both emergency generator and normal power supply are in good condition. Check condition of remote units, recorders, tone relays, telemarks, etc., for good condition.

## CHAPTER 5 - ROADS, GROUNDS AND RECREATION AREAS

a. Roads, Parking Areas, Trails and Walks. (1) Continuous visual inspection for irregularities such as slides, settlement, rutting, pot-holes, washouts, pumping; damage to signs, guard rails, abutments, retaining walls, culverts and other hazardous conditions. Hazardous conditions shall be corrected immediately. During or following heavy rains or storms. Inspect for flooding, washouts, settlement, slides, fallen trees and other obstructions.

(2) Pavements. Visually inspect all pavements annually to determine the need for repairs to expansion joints, cracked or broken sections, settlement due to failure of subbase or subgrade material, drainage or subgrade, scaling, spalling, abrasions, raveling at edges of flexible pavements, potholes, rutting, shoving, bleeding, weathering surface drainage, wash boarding, and excessive amounts of dust. Perform all seasonal maintenance operations, to extent of available equipment and personnel, such as cold patch repairs, crack and joint filling, etc., at the proper time and according to the best practices in the area for maximum benefits. Roads will be resurfaced and/or sealed with the type of surface originally constructed; Operations Division to be notified through Reservoir Manager of pavements requiring reconstruction, repair or sealing.

(3) Shoulders and Roadside. Inspect annually all shoulders and roadside for drop-offs from pavements, rutting at pavement edge, proper slope for drainage, proper width, stability, slides, gullying, and obstruction to vision. Shoulders must be maintained with a smooth surface flush with adjoining pavement and to correct slope, width, and section. Keep shoulders and roadside clear of tall weeds and brush. Preserve and plant grass where it assists in preventing soil erosion. Sod, shrubs, or plant vines when grass seed will not grow on eroding slopes.

(4) Walks, Roads and Parking Areas. All gravel and dirt access roads and parking areas in the dam and recreation areas will be maintained in good condition and repair throughout the season. Calcium chloride or other dust retarding agents will be used when prolonged dry weather creates a safety hazard. Bumpers of concrete, stone or wood will be provided in and around the outer edges of parking areas for uniform alignment of and to exclude vehicles from blocking emergency exits or trespassing on grassed areas. Rules and regulations are to be conspicuously posted off parking areas.

(5) Paths and Trails. Throughout the recreation area and reservoir continuing inspection shall determine the brush and trees which have to be removed. This is especially true after flood water impoundment. Low hanging limbs and side brush must be removed. At projects where trails are used during winter months, trail signs and small stream crossings should be inspected regularly.



b. Traffic Services and Signs. (1) Traffic Services. Inspect traffic services annually for legibility, damage, obstruction from view, signs and markers conforming to highway standards as to size and shape; automatic devices operating properly; guard rails, snow fences, and traffic control devices in good repair; road hazards properly marked by signs, lights, or devices and at proper distances from hazard; detours properly marked; traffic lanes plainly and properly marked.

(2) Signs. All rustic directional, warning and project identification signs in recreation areas shall be taken down at the close of the season, stained, lettering repainted, and insignia replaced if required. These signs will be stored under cover. The formula for the stain shall be 1 part burnt amber coloring, 2 parts turpentine and 10 parts boiled linseed oil. Standard highway type metal signs shall be removed and stored also. Replacements and additional signs or posts will be ordered before commencement of the recreation season through the Reservoir Manager. All wood sign posts in place are to be given a coat of stain, if weathered, before attaching signs. Permanent signs shall be repainted as required.

c. Drainage. Inspect semi-annually for adequacy of drainage systems; stoppage or catch basins, culverts, gutters, ditches, under drains; undermining of headwalls, foundations, road shoulders, abutments; ponding, gullying, and clogged drainage pipe. Existing drainage structures such as catch basins, manholes, ditches, gutters, drainage pipe, and flumes must be cleaned periodically in order that they may be kept free of debris and perform their designed function. As a minimum program, a complete inspection is made in the fall in preparation for the winter season and another in the spring, to determine extent of repairs required. Priority for accomplishing drainage maintenance shall be in accordance with established priorities.

d. Guard rails and fences. (1) Concrete posts, metal posts and rails, and partially treated wood posts in guard rails and fences will be painted all white. All fence rails will be painted white; creosoted wood posts will not be painted. Decayed wood posts and broken concrete posts should be replaced and wire cable kept at the proper tension. Steel or concrete guard rail posts shall be replaced when unserviceable and painted when required. Wood and metal guard rail and posts shall also be checked frequently and painted when weathering is observed.

(2) Fences. Inspect annually to determine the need for repairs to gates, locks, and fencing. Fences and accessories shall be maintained to provide the maximum security for which they were designed. Repair all breaks as soon as they are discovered, replace unserviceable gate locks, promptly. To maintain harmony with adjacent areas subject to public scrutiny, painting may be desirable. Painting of other fencing is not considered to be economically justifiable.

(3) Chain link fencing will generally not require painting. If required due to excessive rusting, etc., the Reservoir Manager should be notified.

e. Grounds. (1) General. Visual inspection for loss or damage to vegetation, need for mowing, insect control, ponding, flooding, erosion, clogged or overgrown streams or drainage system, damaged fences, gates, trees, shrubs and vines.

(2) Improved Grounds. Close inspection annually by experienced personnel for soil deficiencies, damaged trees, shrubs, erosion, and vegetation; need for topsoiling, reseeding, sodding; weed, dust, and insect control; pruning, trimming, planting, and mulching. During or following storms, heavy rainfall, or drought make an inspection for flooding, downed trees, damaged trees, shrubs, vegetation and need of repairs. Improved grounds generally consist of lawns in vicinity of operators quarters and other buildings, all landscaped areas, and recreational areas and should be maintained in keeping with the use and intensity of such use.

a. Grassed areas, under normal conditions, should be mowed during the active growing season to a height of 1-1/2 to 2 inches. Mowing should be no more frequent than necessary to prevent the grass exceeding a height of 3 to 5 inches. Reseeding, weed control, fertilizing, and irrigating should be performed only when the appearance of the grass indicated a need for such treatment.

b. Shrubbery should be trimmed in accordance with the requirements of the species and as needed to present a suitable appearance.

c. Shade and ornamental trees. To avoid frequent re pruning, anticipate tree growth for two to three years and prune accordingly. Remove dead or broken branches or those that extend over buildings and shape to present a suitable appearance.

(3) Semi-improved Grounds. Inspect annually to determine the need for mowing, reseeding, sodding, trimming, pruning, removal of brush and flammable vegetation from under and around wood structures, erosion and dust control; clearing of streams and drainage ditches, and application of fertilizers. Semi-improved grounds consist of roadsides, shoulders, open areas adjacent to lawns and similar areas and which require less attention than do improved grounds. These areas should be mowed with tractor-operated equipment to a height of 2 inches or more when the grass reaches a height of 5 to 7 inches or when excessive uneven growth of grass or weeds becomes unsightly. Reseeding and fertilizing is limited to kind and rate necessary to sustain vegetative cover for the control of erosion by wind and water. Drainage ditches, gutters, and channels should be cleaned of wooded plants, vegetation and other matter that restricts flow, at least once a year.

(4) Unimproved Grounds. Inspect annually to determine the need for erosion and dust control; clearing fire lanes, power and communication lines right-of-way; mowing of flammable vegetation. Unimproved grounds are areas that do not fall within categories above and require only minimum maintenance. Clear firebreaks and clean under and around wood structures yearly. Anticipate tree growth for two to three years and remove branches overhanging buildings, roads, power and communication lines accordingly.

f. Sanitary Facilities. Roof, exterior and interior are to be inspected regularly for deterioration and signs of vandalism. Major repairs and painting should be scheduled during periods when usage is at a minimum. All doors shall be checked to ascertain that they operate properly and that latches are in good working condition. Facilities will be kept scrupulously clean and all necessary accessories provided the visiting public. Fixtures in latrines shall be cleaned daily and odor suppressants added to pit latrine when required. All holding vaults or tanks should have solids removed and be properly flushed by a contractor specializing in septic tank service. It is mandatory that pit latrines, holding tanks or vaults be cleaned or pumped out at the end of each recreation season.

g. Picnic Facilities. Picnic tables require periodic cleaning by washing with a detergent. Tables shall be treated to combat grease and similar type stains. Unserviceable table tops or seats shall be replaced. Wood tables not anchored will be placed on end during the winter months. Brush and debris shall be removed on a regular basis. Poisonous plants shall be sprayed with approved weed or brush killer. Grilles, barbecues, and fireplaces shall be maintained in safe condition and shall be repaired when deterioration is evident. Units beyond repair are to be replaced. In dry season precautions will be taken to cope with fire hazard. Hazardous trees will be trimmed or removed. Aeration of soil should be accomplished in areas where ground has become compacted to a degree that it is injurious to trees. Picnic areas will be maintained in a clean and sanitary condition.

h. Refuse Collection. (1) Visual inspection weekly during the active season to determine the police of area, frequency of collection, and condition of containers. Inspect area following severe storms or flooding to determine extent of damage, loss of containers, or existence of any health or safety hazards.

(2) Trash containers will require emptying and cleaning as frequently as the visitation load dictates. Paint containers inside and out as required and the letters PLEASE stenciled on, using white paint. During the off season, the barrels are to be inverted when stored outdoors.

i. Insect and Rodent Control. Visual inspection to detect breeding places where treatment will be most effective, such as ponds, swamps, and thick tall vegetation. The nature and degree of insect and rodent control will be sufficient to meet requirements of State and/or local health agencies. The extent and intensity of larviciding will be frequent enough to maintain a level of *Anopheles quadrimaculatus* below the level determined acceptable by the State health agency. Drift should be piled and removed during draw-downs for more effective mosquito control areas. Intense public use may require spraying to control insects in picnic areas. The application of chemicals will be confined to refuse collection points and around toilets but not on picnic tables where food could be contaminated. Poison to control rodents will be used in a manner that will not permit harm to public.

j. Snow Removal. During winter months all access roads designated by head dam operator shall be kept plowed and sanded. Provide stakes where necessary (in full) to outline limits of roadways and parking areas to avoid damage to areas and structures beyond limits of pavement.

k. Removal of Dead and Down Timber. The reservoir area, particularly in the lower levels, will be kept cleared of all down and dead timber. This may be disposed of by chipping the slash and the timber which is of no value; it may be cut into four-foot lengths and used by the dam operator or, if any merchantable or salable quantities are available, it will be sold by the Supply Division of the Division Office. Chips may be spread as a mulch on slopes above spillway level.

l. Cutting of Wood by Others. All standing timber in the reservoir area, as well as other natural resources, is Government property. Therefore, the dam operator is not authorized to permit any person or persons to cut and/or remove any standing timber from the reservoir area or to countenance such removal. Persons desiring to cut wood should be advised to write to the Division Engineer, furnishing details of his proposal, including the information on the size, species, quantity, location, etc., together with an offer.

## CHAPTER 6 - ELECTRICAL AND MECHANICAL EQUIPMENT

### a. Gates. (1) Gates and Guides (Service and Emergency).

(a) Weekly. When and as conditions allow, each gate shall be tested for satisfactory operation.

(b) Quarterly. Thoroughly lubricate gates and hoists. Carefully examine hoisting cables for wear and damaged cable. Lubricate as required.

(c) Annually. Check each gate when full closed for leakage and proper sealing. During operation of the gate hoists, check bearings, wear on gear teeth, and brake shoes. Check limit switch contacts for cleanliness, pitting and corrosion. Check the closing limit switches setting, stretching of the hoist cables may necessitate adjustment of the switches. These switches shall be so adjusted that the weight of the gate is off the cables when the gate is in the closed position; however, serious damage to the cables will result if the cable is allowed to become loose enough to fall off the sheaves of the lower block. Check seals, roller race guides, and roller chains on all gates, clean and replace damaged seals and other items if necessary. The roller chains are hardened stainless steel and paint or lubricant should never be applied to them. All rusted metal on the gates shall be thoroughly wire-brushed and spot painted.

(d) Observe if there is any vibration during raising or lowering of gates in water.

(2) Motor Operated Floor Stand Operations. Annually. Floor stand operator motors shall be oiled once each year, or more often if required by the manufacturer's recommendations. The end bearings and the worm in the limit switches shall be oiled with a few drops of S.A.E. 20-W oil.

b. Crane and Hoists. (1) Safety and Warning Devices. (a) Annually. Inspect to see that all safety and warning devices are in service and in a safe and proper operating condition. Dam operator shall prepare a list of all items required to be inspected--this information is available from operating manuals. Repair or replace worn, broken or unsafe operating equipment as necessary.

(b) Semi-Annually. Crane and hoists used at infrequent and varying intervals shall have a good visual inspection of all safety and warning devices thereon and all devices found unsafe or defective put into a safe and proper operating condition before using the equipment.

(2) Operational Tests. (a) Weekly. All crane and hoist equipment will be operated a sufficient length of time to determine that the equipment is in a safe and satisfactory working condition and ready for service. These functions include the bridge traverse, the trolley traverse, the raising and lowering of the hook and all its speeds.

(b) Annually. Dynamometer test for crane as directed by Operations Division.

(3) Crane and Hoist Brakes. (a) Semi-Annually. Inspect brake lining and renew if needed. Check brake drums for scoring. Repair or replace as necessary. Adjust brake and spring tension. Renew springs if stretch indicates fatigue. See that thruster is in good condition. Adjust and repair to assure safe operation.

(4) Shafts, Couplings and Bearings. (a) Annually. Visually inspect shafts, couplings and bearings for indications of excessive wear. Lubricate according to manufacturer's recommendations.

(b) Two Years. Examine shafts and couplings for indication of misalignment. Adjust, repair and lubricate as needed. Flexible couplings shall be repacked with grease according to manufacturer's recommendations. Adjust or replace bearings if clearances are excessive.

(5) Gears and Gear Boxes. Two Years. For open gears, observe, and for enclosed gears, listen for indications of broken or excessively worn teeth, misalignment or improper meshing. Check gear box shaft packing and joints for leakage. Make necessary repairs and adjustments to assure proper operation. Lubricate according to manufacturer's recommendations.

(6) Lifting Beam. Before using, check for alignment, corrosion and tightness of rivets and bolts. Check condition of pins. Lubricate as needed. Observe carefully for any indications of over-stressed members.

(7) Blocks and Hooks. (a) Inspect blocks and hooks before lifts. Check safety latch on hook.

(b) Semi-annually. Inspect for indications of bending or stretching of the hook.

(8) Rails, Supports and Stops. 2 Years. Inspect for misalignment and obstructions. Check concrete supports for cracks and spalling, steel supports for corrosion and loose rivets and bolts. Repair, tighten, caulk, etc., as needed to assure safe and proper operation. Check stops for proper condition and security. Repair or adjust as needed.

(9) Bridge and Carriage. 2 Years. Inspect framework for looseness and cracks. Check rivets and bolts for tightness. Observe girders for corrosion and indications of misalignment. Take necessary remedial action to maintain in satisfactory and safe operating condition.

(10) Trucks and Wheels. 4 Years. Inspect trucks for slew and condition of metal. Examine wheels for excessive wear and flats. Rebuild or machine wheels as needed. Repair and clean as necessary.

(11) Bumpers. 4 Years. Examine for looseness. See that bumpers and/or stops are properly positioned. Tighten or adjust as necessary.

(12) Crane and Hoist Cables. Annually. A good visual inspection shall be made of the cables for kinks, frayed cable and corrosion. Lubricate the crane and/or hoist cables. Clean cables by wire brushing, scraping or blow down with compressed air. Apply lubricant with a stiff brush, passing the cable through a lubricant saturated waste or drip on at a point where the cable opens slightly from bending.

(13) Crane Trolley System. 4 Years. Check for broken insulators, condition of trolley wires or rails, shoes, and wheels. Clean and check slack in the trolley conductors. Check brush rigging.

(14) Power Supply Cables. (a) Annually. Visual inspection for condition of cable, plugs and receptacles.

(b) 2 Years. Examine cable, plugs and receptacles closely. Check condition of retractable cable needs and connections to collector rings. Repair as necessary.

(15) Hoists. Annually. Inspect hoisting machinery for gates and crane hoist to determine general condition. Check for worn or defective links, pins, hooks, cables, and see that components are properly lubricated. Repair or replace excessively worn or defective parts and apply lubricant or preservative, to maintain equipment in satisfactory and safe operating condition.

c. Generators and Motors. (1) Generator and Motor Foundations, Bases or Supports. When making an operational tour, observe for any unusual conditions. For generators, integral horsepower motors and engines, inspect for cracks or other damage. Inspect anchor bolts for indications of looseness. Observe for signs of loosening or damage to dowel pins (if provided). Tighten or repair as necessary.

(2) Standby-Units: Operational. (a) Weekly. Each standby unit shall be operated each week to bring engine to operating temperature. Before and after each weekly run, the level of the water in the radiator and the oil in the crankcase shall be checked. After each run, the exhaust piping shall be drained of condensate. The weekly testing of equipment shall be done while the standby unit is being operated, with the standby unit furnishing all the energy. Before, during and after, the weekly test operation, operation data will be recorded on Standby Electric Generator Unit Location Form. Any malfunction of the unit shall be repaired if possible by the dam operator, and reported to the Reservoir Manager if it cannot be repaired. The crankcase oil shall be changed every 100 hours of operation or every 6 months, whichever is sooner and when the oil is at operating temperature so that complete drainage will result. Replace the oil filter element every other oil change.

(b) Monthly. Once a month the standby unit operational run shall be extended to 2 hours. Carefully inspect the storage battery, air cleaner, oil filter, fuel pump and service according to instructions furnished by the engine manufacturer. Operational data will be recorded on Standby Electric Generator Location form.

(c) Monthly. Operational Test. Inspect commutator, collector rings and brushes for satisfactory operation. Observe brushes to determine if replacement is required. Inspect condition of commutator and collector rings, polish if grooved or rough. Commutators and collector rings with a good surface and polish should not be disturbed. Wipe commutator and collector rings with canvas.

(d) Antifreeze no longer requires draining at the end of each cold weather season; it may be retained in the cooling system for an extended period dependent on the outcome of a hydrometer test accomplished during performance of scheduled Preventative Maintenance Service on the engine.

(e) Annually. Clean the slip rings and commutator and blow out same with dry compressed air.

(3) Brush Rigging. Annually. Inspect the brush rigging and tighten bolts, screws and connections. Check brush spring tension and brush fit. Replace brushes as necessary.

(4) Motors, Fractional Horsepower. Fractional horsepower motors will be given periodic visual inspection as scheduled by the head dam operator. Attachment bolts or screws tightened. Motors lubricated in accordance with project lubricating schedule. Clean external surfaces, check motor couplings, pulleys and belts, tighten or replace as required.

d. Electrical Equipment. (1) Primary Equipment and Cables. No attempt at maintenance of the primary equipment, cables and transformers shall be made by operating personnel. A visual inspection shall be made and any maintenance or repairs required shall be reported to the Utility Company and the Reservoir Manager.

(2) All maintenance in connection with the following items will be performed by personnel from Operations Division.

(a) Switchboard Wiring and Generator. Annually. Check switchboard, secondary wiring and generator cables. Check all lugs and connections for tightness. Check ground connections for continuity. Perform insulation tests on all circuits, motors and generator windings.

(b) Knife Switches. 2 Years. Examine for evidence of heating; see that hinges and contacts are in order and that interlocks, if provided, are in good condition. Repair or replace as needed.

(c) Motor Starters. 2 Years. Examine starters for condition. Repair and replace parts necessary to place starter in good operating condition. Check auxilliary contacts and interlocks for proper operation. Check motor control devices for satisfactory operation.



(d) Control Cables (Including single conductor control wiring). Examine monthly exposed sections of cables for signs of overheating, corrosion or other damage to insulation or sheath, supports, and terminations.

(3) Storage Batteries. Monthly. Check for leaking battery cases. Check and record specific gravity of all cells. (Note condition of hydrometer, replace if required). Clean corrosion products from inter-cell connectors and terminals. Add distilled water as needed. Coat connections with a film of battery terminal grease. Follow battery manufacturer's instructions for giving batteries an equalizing charge.

(4) Lighting (as required). (a) Replace burned out lamps. Replace flashing fluorescent lamps as soon as possible. Continuous flashing may damage the ballasts.

(b) Replace broken parts.

(c) Clean reflectors and lenses.

(d) Replace defective switches.

(5) Switchboard and Panels (Annually).

(a) Check all fuses. Keep spare fuses on hand. Locate and correct source of trouble before replacing fuses. Use proper rated fuse. A higher rated fuse will not protect circuit. Do not insert fuse on live circuit because it may arc and cause a poor contact and blow fuse. Make sure fuses are tight with good contact.

(b) Check breakers for operation.

(c) All connections should be tight. Check all bolts, screws and clamp and tighten if loose.

(6) Readings (Semi-annually).

(a) Check voltage. Voltage that is too high or too low will affect the life, efficiency and economy of equipment.

(b) Check motor currents observed with nameplate ratings.

(c) Check frequency.

(d) Meggar all feeders and circuits (by personnel from Operations Division).

(e) Meggar all generator and motor windings (by personnel from Operations Division).

- (7) Interlocks (Annually).
  - (a) Check interlocks for proper operation.
  - (b) Check padlocks and locks on electrical enclosures.
- (8) Rubber Mat. Maintain a clean rubber mat in front of switchboard.
- (9) Lightning Protection (Annually).
  - (a) Check continuity of ground wires.
  - (b) Check flagpole ground.
  - (c) Check arrester grounds.
  - (d) Check antenna mast ground.
  - (e) Check switchboard ground.
  - (f) Ground wires exposed to mechanical injury should be protected by conduit.
- (10) Receptacles (Annually).
  - (a) Replace defective units.
  - (b) Check ground continuity on grounding type.
- (11) Portable Cords.
  - (a) Arrange cords so that electrical connection bears no mechanical strain.
  - (b) Protect all lamps used with an extension cord with a lamp guard.
  - (c) Check insulation and plugs.
- (12) Wiring.
  - (a) Check for proper support.
  - (b) Check insulation for deterioration caused by age, abrasion, moisture, oil, heat or other causes.
- (13) Neutral. Check neutral ground on supply. This ground is usually connected to a metallic water piping system on the street side of any meter which could interrupt the continuity of the metallic circuit to ground. Check connections for tightness.

e. Sumps and Sump Pumps. Check area drains into sumps, floats, switches and motors for proper operation quarterly. Repair pumps and accessories as conditions or performance indicate. Clean area drains, drainage system, and sumps as necessary.

## CHAPTER 7 - FIRE PREVENTION

a. General. All fire fighting equipment must be kept in instant readiness for operation at all times. At least four fire rakes will be kept in a place readily accessible.

(1) During times when there is a danger of forest fires, the dam operator shall be on the alert for fires in the reservoir. He shall be familiar with all sources of water in the reservoir area and during the dry season shall have up-to-date information as to the availability of water. In areas distant from the river, water holes in low areas will be developed to provide a supply. Existing water holes shall be kept well cleaned out. A substantial fence shall be kept around all water holes for purposes of safety.

(2) The dam is provided with a portable fire pump with a complement of accessories and 1-1/2" hose. Observe pump and associated equipment weekly for general condition. This pump shall be assembled with its accessories once a month (except during the freezing weather) and run for a short time. Chapter 1 includes a list of the equipment to be included with the portable fire pumps. All of the equipment given in the list shall be kept in one place and ready for instant use at all times. It must be borne in mind that when this equipment is needed, the personnel sent to get it will be excited and hurried, and unless all the equipment is grouped in one place, some important item may be overlooked resulting in serious delay.

b. Extinguishers.

(1) Carbon Dioxide (CO<sub>2</sub>) Extinguishers.

Monthly. Visual inspection for proper location and condition. Check seals.

Semi-annually. Weigh units and recharge if weight is more than 10 percent less than normal. See Paragraph c (1) for test.

(2) Dry Chemical Extinguishers.

Monthly. Visual inspection for proper location and condition of extinguisher.

Semi-annually. Inspect chemical for condition. Weigh cartridges to determine charge. Repair and refill as required. See Paragraph c (2) for test.

(3) Chemical Solution (Soda-Acid) Extinguishers. Inspect monthly for proper location and condition. Check hose for obstructions. Inspect interior for corrosion, quantity and quality of acid and soda. Clean, repair, or replace as needed. Perform this work twice a year. Discharge, clean and recharge extinguishers annually. See Paragraph c for test.

c. Testing Extinguishers.

(1) Carbon Dioxide (CO<sub>2</sub>) Extinguishers. Perform hydrostatic cylinder test in accordance with Interstate Commerce Commission (ICC) test procedure;

(a) When emptied by use, if time elapsed since last test exceeds five years, or

(b) When time elapsed since last test exceeds twelve years, or

(c) When corrosion, damage or the like warrant regardless of time elapsed.

(2) Dry Chemical Extinguishers. Return to manufacturer for inspection and test;

(a) Every five years, or

(b) When corrosion, damage or the like warrant regardless of time elapsed.

(3) Chemical Solution. In accordance with the National Board of Fire Underwriters (NBFU) hydrostatic test procedure.

(a) Every five years, or

(b) When corrosion, damage or the like warrant regardless of time elapsed.

d. Fire Hose.

Monthly. Visual inspection monthly of nozzles and connections. See that the hose is hung in proper position and place for use in case of fire.

Annually. Test all hose annually except unlined linen hose at system pressure. Defective hose will be replaced with new hose.

5 Years. Test unlined linen hose every five years at 25 pounds higher than normal system pressure.

e. Nozzles and Playpipes. Visual inspection monthly for condition. See that equipment is kept in the proper place for ready use. Repair or replace as needed.

f. Fire Doors. Inspect and manually operate monthly to insure equipment is in good operating condition.

g. Flammable Waste Containers. Observe that containers are in the proper locations; that proper type containers are being used and are in good condition. Observe that lids fit securely. Be sure that flammable waste is properly disposed of.

h. Fire Warning Signs. Observe that adequate warning signs are properly located. Check signs for good condition.

i. Fire Plan and Emergency Instructions. Observe adequacy of posted fire and emergency instructions monthly. Check adequacy, condition, and current status annually. Revise as required.

## CHAPTER 8 - ENVIRONMENTAL PROTECTION

a. Scope. The dam operator shall perform his operating and maintenance work in such a manner so as to prevent, to the extent practicable, environmental pollution as the result of Government activities as well as activities by others on the Government property. For the purpose of this manual, environmental pollution is defined as the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to man; or degrade the utility of the environment for aesthetic and recreational purposes. The control of environmental pollution requires consideration of air, water, and land, and involves noise and solid waste-management, as well as other pollutants.

b. Regulations. In order to prevent, and to provide for abatement and control of, any environmental pollution arising from the activities of the Government personnel and others on the reservoir, the dam operator shall make sure that all people using or working at the project comply with all applicable Federal, State and local laws, and regulations concerning environmental pollution control and abatement, and all applicable provisions of the Corps of Engineers Manual, EM 385-1-1, entitled "General Safety Requirements," latest issue in effect.

c. Air Pollution. Some forms of air pollution control are covered in other chapters such as dust control and maintenance of rocks and herbicides and insecticides. Further, EM 385-1-1, "Safety - General Safety Requirements" requires control of air pollution wherever it is a safety and health hazard. Air pollution originating and caused by project operations shall be eliminated or decreased. The dam operator shall comply with project air pollution standards set forth by Federal, State and local agencies.

d. Water Pollution. Care shall be exercised not to pollute the rivers and to maintain water quality standards. Major sources of water pollution are wastes from floating plant (fuel, oil, grease), herbicides and insecticides, sanitary and other waste disposal from buildings, shops and storage areas, and spillage of fuel, grease, oil, etc.

e. Land Despoilment. Of all forms of despoilment by land equipment, landscape defacement is the most permanent. When a tree is removed needlessly or damaged by burning waste too close to it, repair or replacement takes years. When a fill of the earth, gravel, sand, etc. is made in the wrong place, the environment may be marred for the life of the project. Common land despoilment actions include destruction of land forms and vegetation and pollution of the land by spillage and waste. Outside of recreation and similar areas, care shall be exercised in controlling public travel or usage.

f. Noise Pollution. This area of pollution includes a wide range of causes, from faulty mufflers on equipment to use of explosives. Noise pollution is most serious in congested areas and in enclosed operations. The dam operator shall make every effort to reduce and control generation of noise detrimental to human environment due to Government activities including control due to a variety of noise producing operation and maintenance machinery and activities.



## CHAPTER 9 - MISCELLANEOUS

a. Mobile Equipment, Tools, etc. (1) General. The maintenance and operation of a flood control dam requires a substantial amount of property, tools and equipment. It is the policy of the New England Division to provide the dam operators with sufficient tools and equipment to properly maintain and operate the dams, related structures and reservoir with a maximum of efficiency. The dam operator must bear in mind that the more tools and equipment they acquire the greater their capability of maintenance.

(2) Government-Owned Miscellaneous Small Gasoline Powered Plant. - Test operate each engine weekly. Check general condition of unit during the test operation and repair any deficiencies noted.

Each engine will be given a thorough check biannually by a competent mechanic. Replace excessively worn parts and repair as necessary.

Check oil, water, and fuel before and after each use. After each use clean and service the unit so that it is ready for the next operation. Always fill the gas tank after each use.

On small miscellaneous plant that is seasonal in use, the engines will be drained, cleaned, and properly lubricated for storage during the non-use season. Batteries, if any, for such plant will be placed on a trickle charger, and their condition checked each month.

(3) Miscellaneous Tools. All items should be kept clean and in good working order at all times. Tools with an edge should be kept sharp. Broken handles on axes, shovels, hammers, etc., should be promptly replaced.

b. Motor Vehicle Maintenance. Preventative maintenance on motor vehicles under the jurisdiction of the Head Dam Operator shall be documented on forms indicated in the governing regulations; AR58-1, ER58-2-1 and TM38-600. ER58-2-1 is pertinent Corps of Engineers regulations on motor vehicles and shall be followed to the letter, no deviation.

c. Maintenance Records. (1) Maintenance records shall be kept on Card Form #314 as required in Engineer Regulation ER-58-2-1, Change 1, Appendix 11, dated 31 May 1968.

(2) Periodic Motor Vehicle Maintenance Guide. This guide will be used as the equipment requires and in conjunction with the Operator's Manual from the manufacturers.

## I. Weekly.

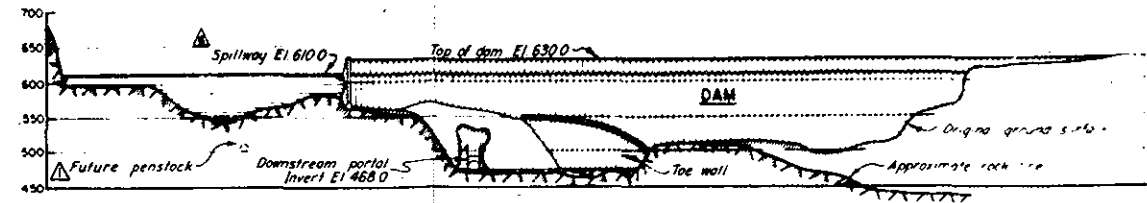
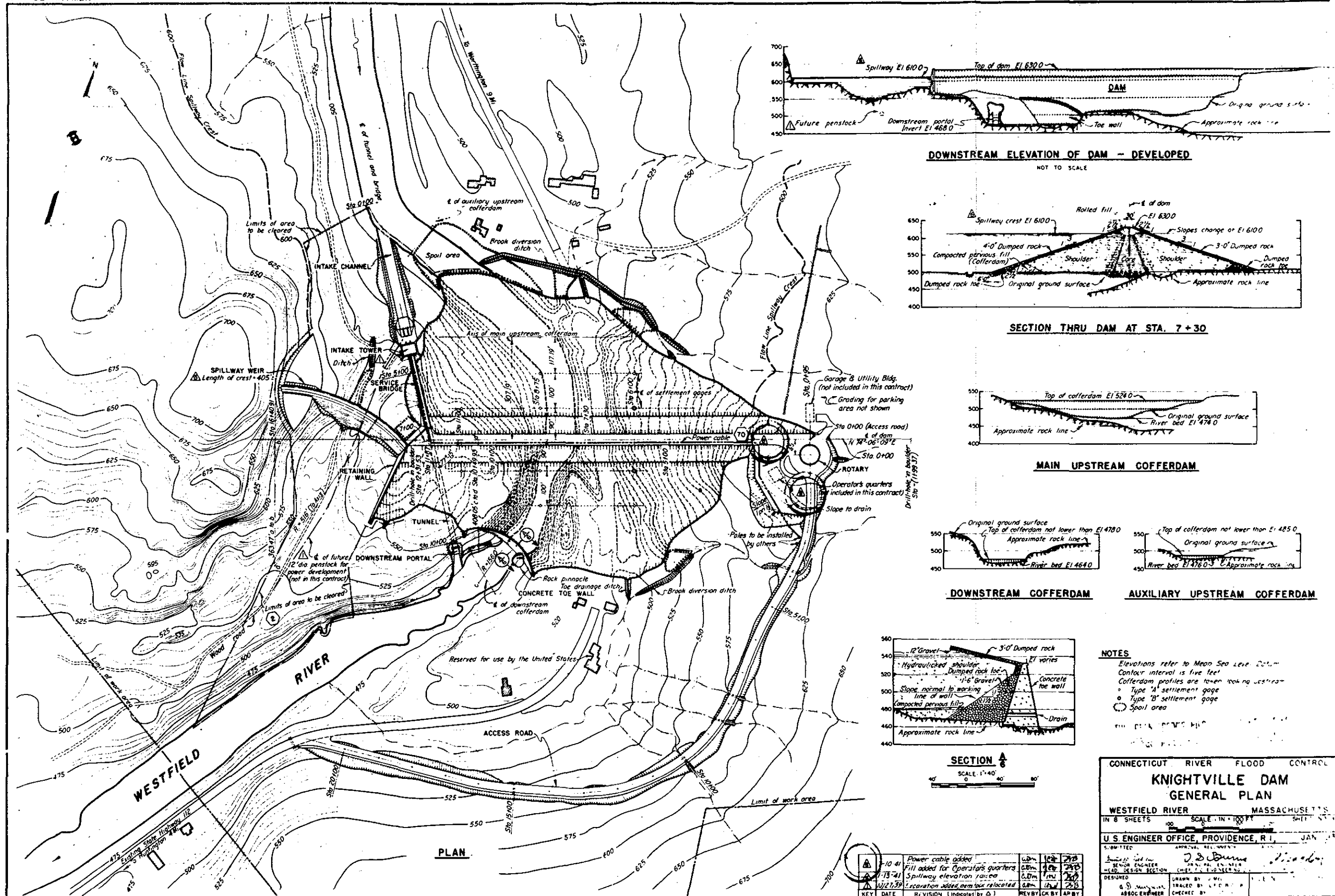
- Check radiator for fluid level and leaks
- Check fan belts for tension and wear
- Check batteries for water level
- Check engine oil
- Check transmission oil if applicable
- Check tires for pressure and abrasions
- Check fuel - keep fuel tank full

## II. Monthly.

- Check weekly items
- Check power steering oil level
- Check brake fluid level
- Check hydraulic fluid level
- Service air cleaner

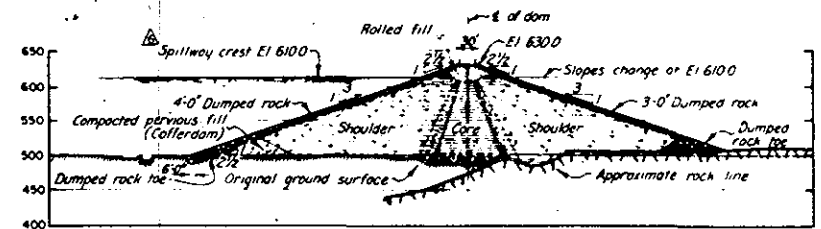
d. Snow Shoes. After the winter period, snow shoes should be wiped clean, the wood and webbing varnished with high grade spar varnish, and stored. Two thin coats of varnish are preferable to one thick one. The shoes should be tied securely, back to back, and a block of wood forced into the space between the toes. They should be placed out of the sun and suspended by a wire so that mice or squirrels cannot get at them.

e. Oil Storage Tanks. Drain condensate from all oil and fuel storage tanks at least once every two years. Clean above ground tanks and repaint or recoat as required. Check liquid level devices for satisfactory operation. Check gage glasses for leaks.



DOWNSTREAM ELEVATION OF DAM - DEVELOPED

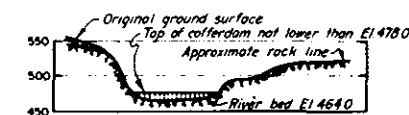
NOT TO SCALE



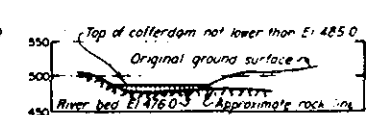
SECTION THRU DAM AT STA. 7+30



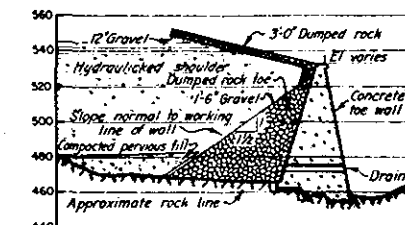
MAIN UPSTREAM COFFERDAM



DOWNSTREAM COFFERDAM



AUXILIARY UPSTREAM COFFERDAM



SECTION A

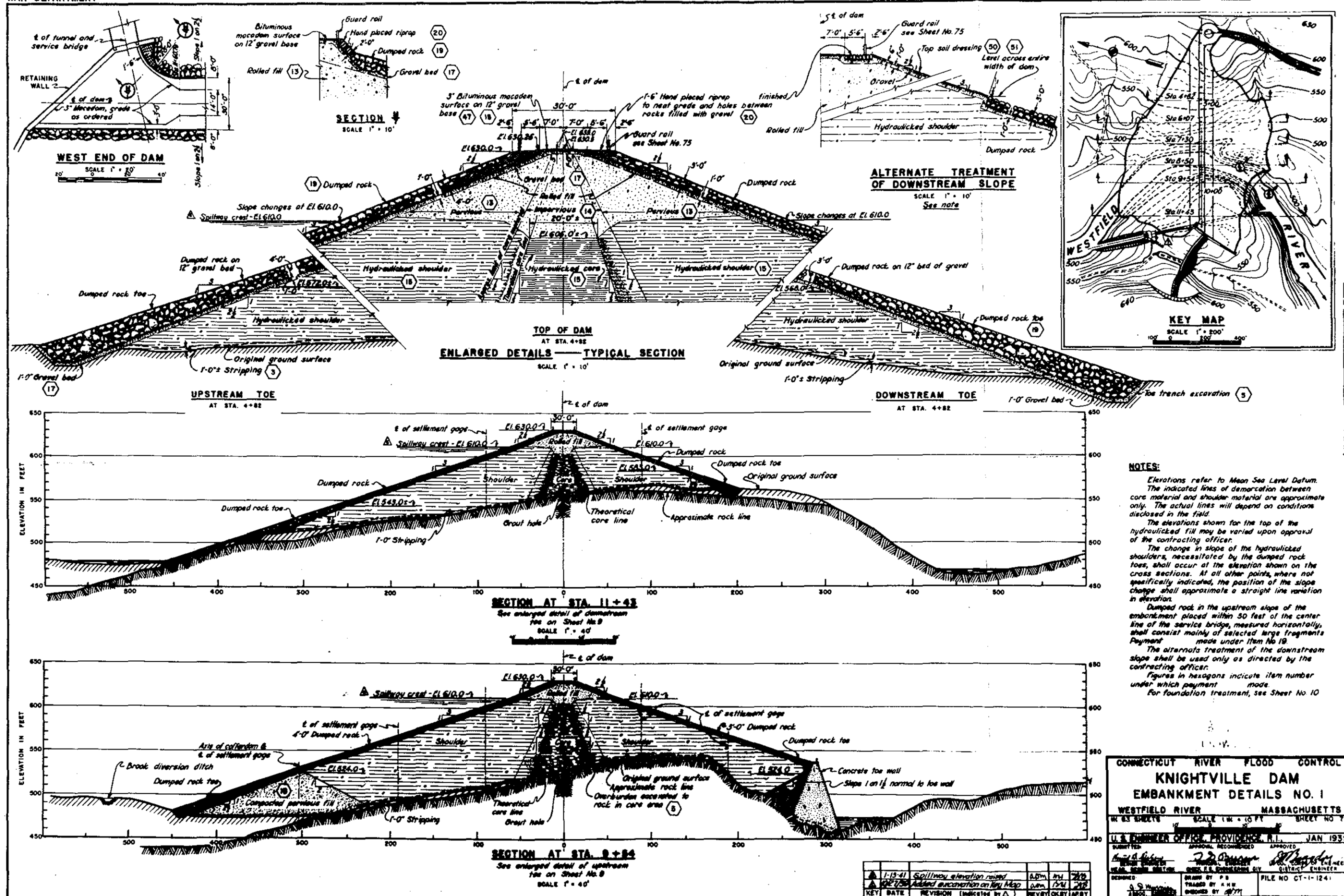
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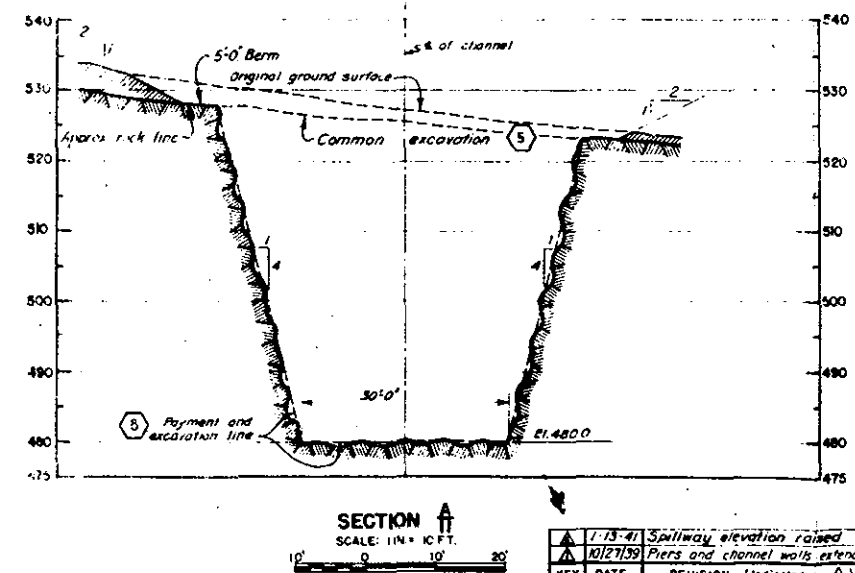
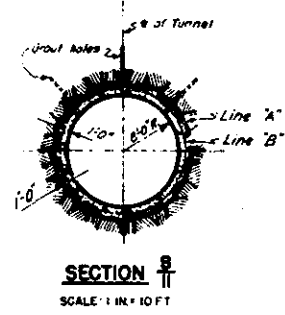
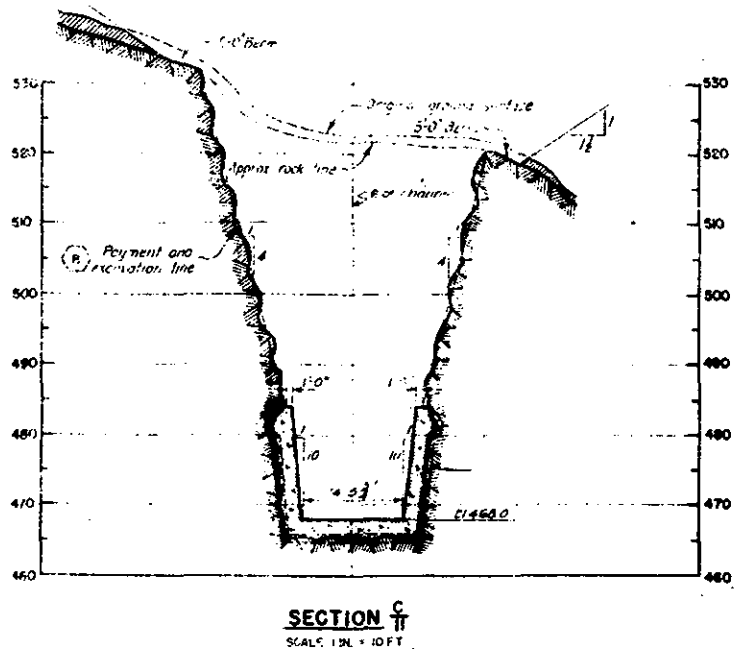
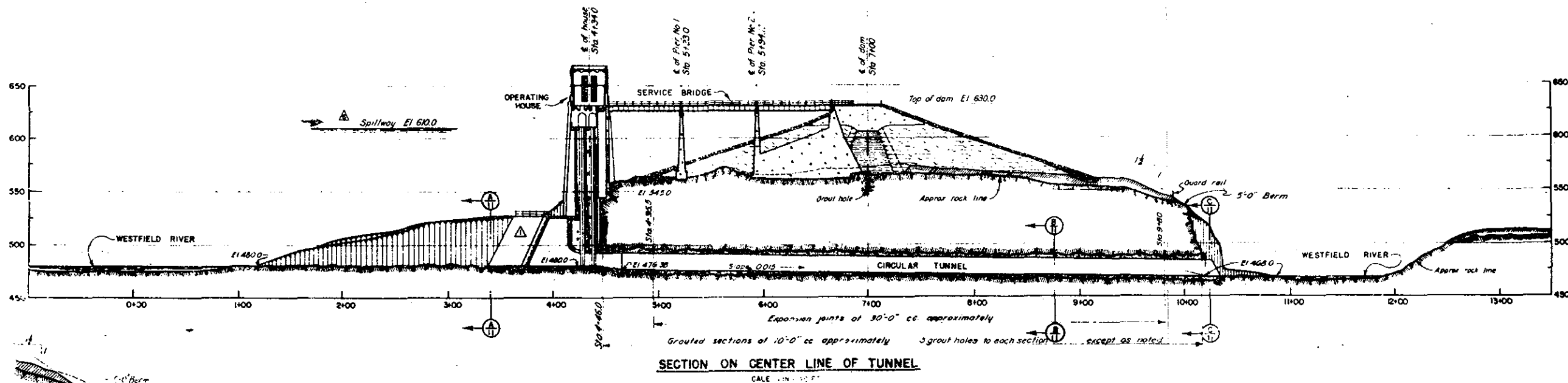
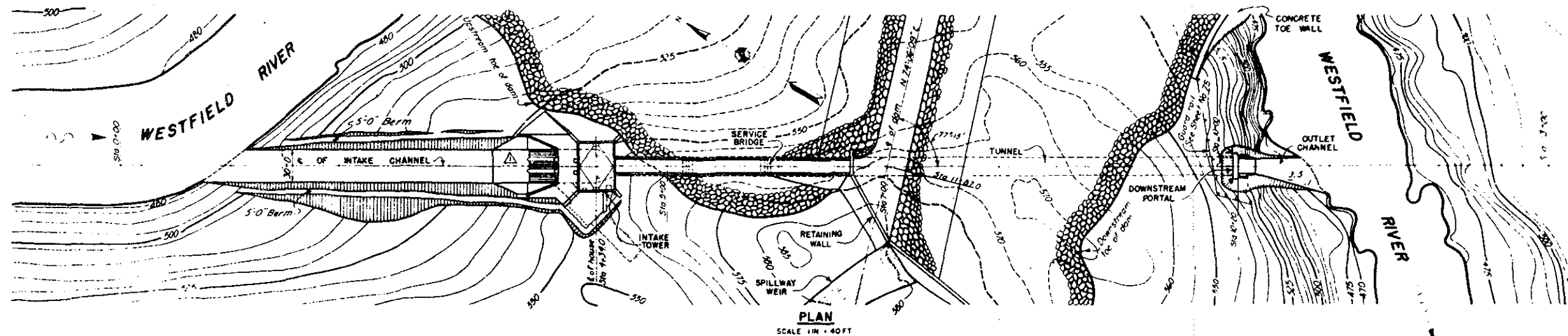
## NOTES

- Elevations refer to Mean Sea Level Datum
- Contour interval is five feet
- Cofferdam profiles are taken looking upstream
- Type "A" settlement gage
- Type "B" settlement gage
- Spill area

CONNECTICUT RIVER FLOOD CONTROL			
KNIGHTVILLE DAM			
GENERAL PLAN			
WESTFIELD RIVER		MASSACHUSETTS	
IN 8 SHEETS		SCALE: 1" = 100 FT	
U. S. ENGINEER OFFICE, PROVIDENCE, R. I.			
JAN 1934			
DESIGNED BY: J. S. Burns		CHECKED BY: J. S. Burns	
DRAWN BY: J. S. Burns		CHECKED BY: J. S. Burns	
APPROVED BY: J. S. Burns		CHECKED BY: J. S. Burns	

PRINTED ...



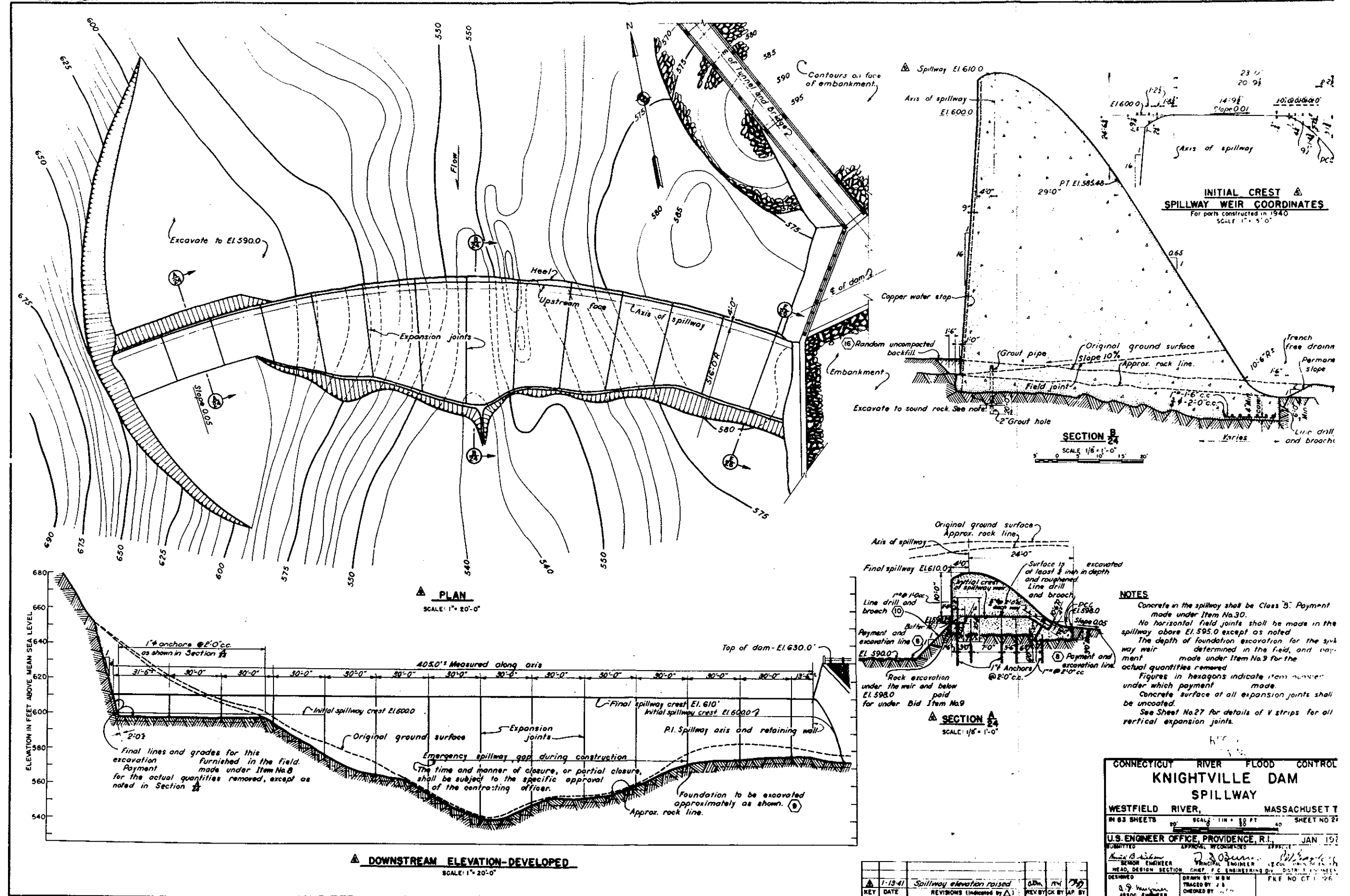


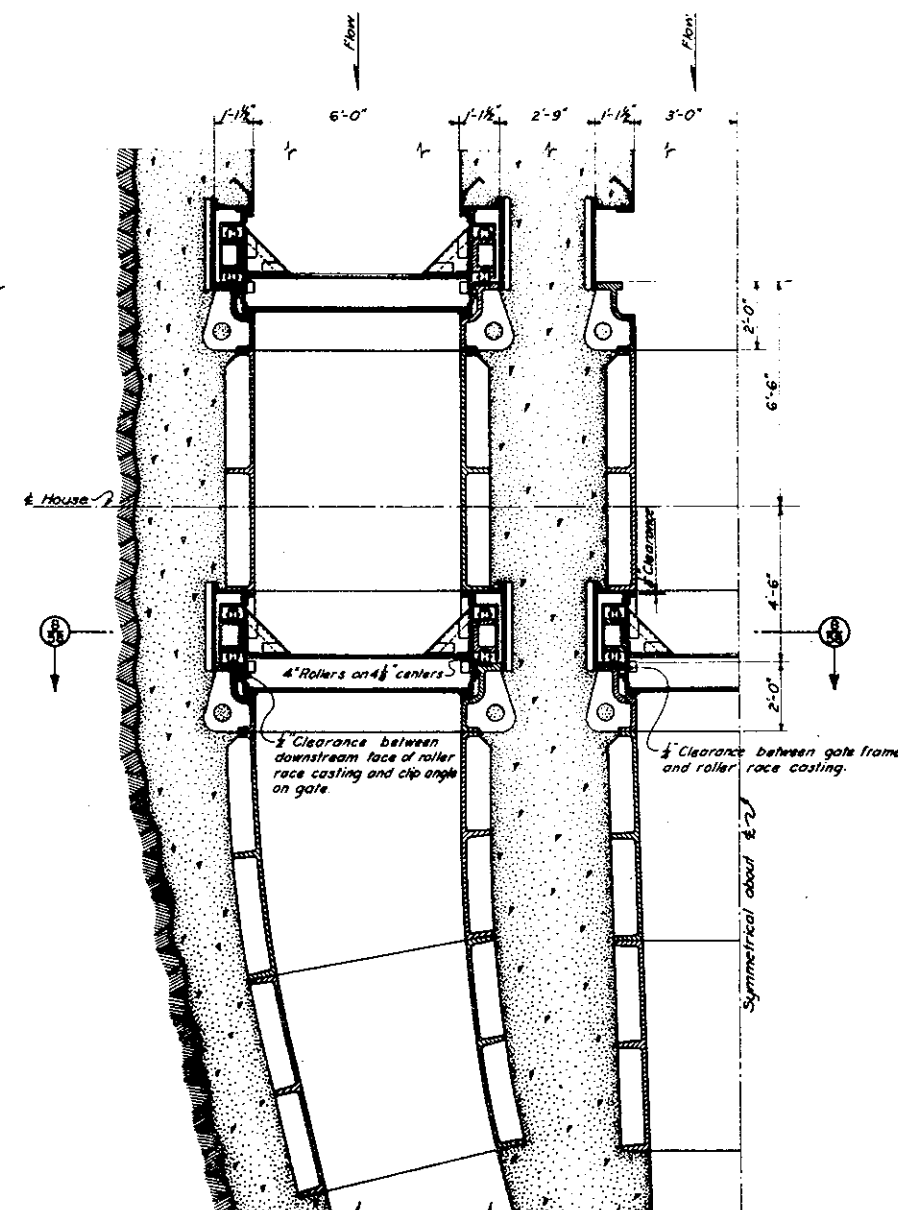
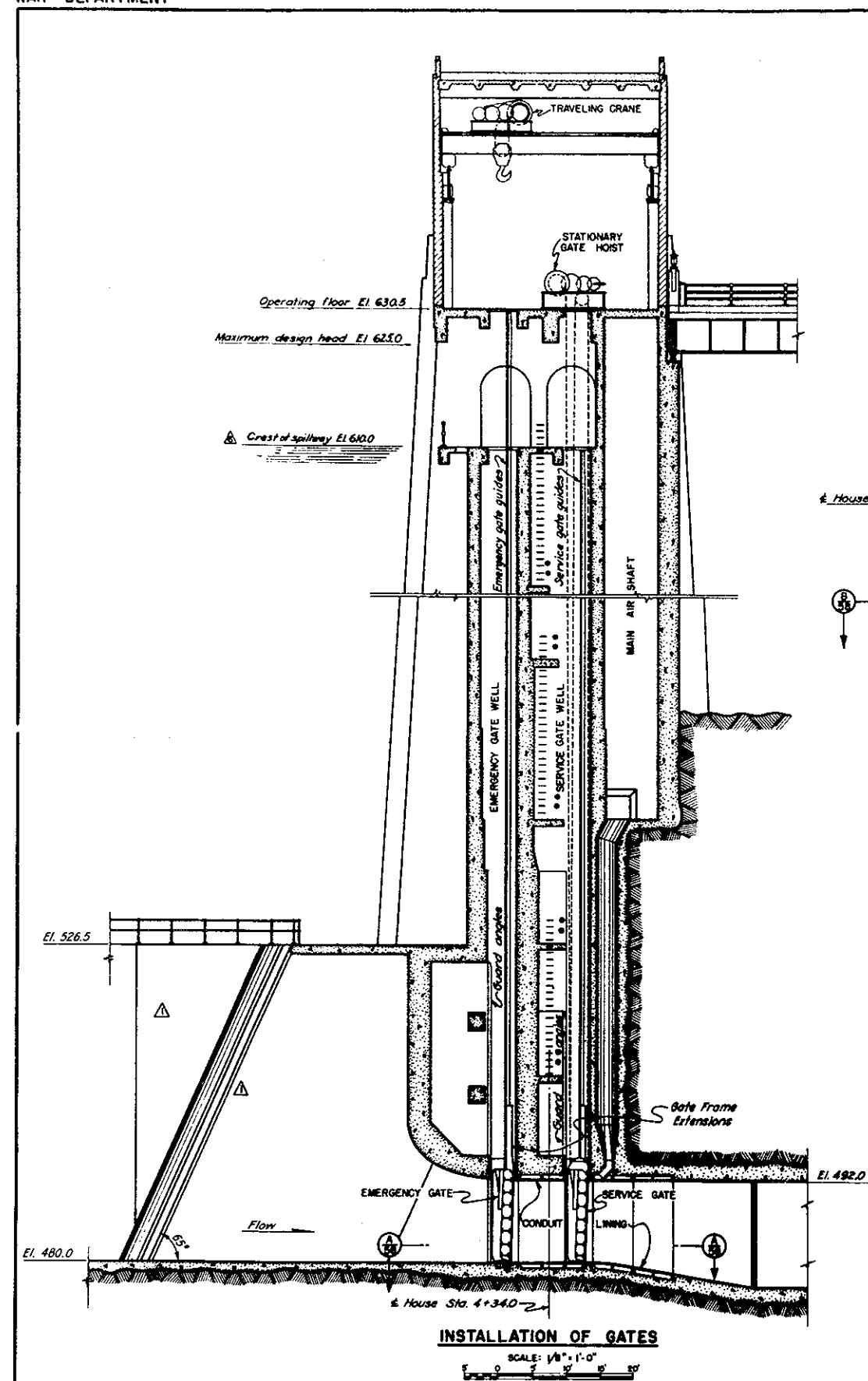
**NOTES**  
Elevations refer to Mean Sea Level Datum.  
The location of the downstream portal is subject to change.  
All expansion and field joints in the tunnel shall have copper water stops.  
Concave interval - 5 feet.  
Figures in hexagons indicate item numbers under which payment will be made.

THIS PLAN ACCOMPANIES CHANGE ORDER NO. 3

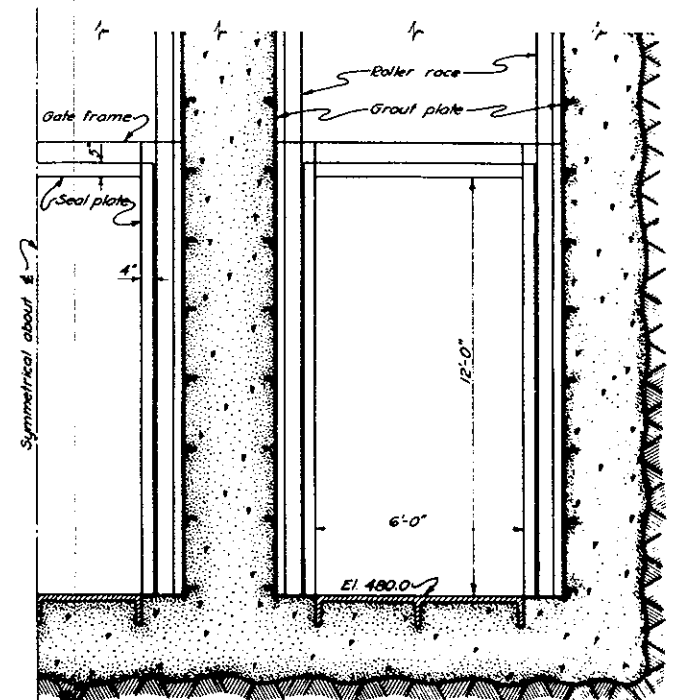
CONNECTICUT RIVER FLOOD CONTROL	
KNIGHTVILLE DAM	
OUTLET WORKS	
WESTFIELD RIVER,	MASSACHUSETTS
11 B2 SHEETS	SHEET NO. 11
U.S. ENGINEER OFFICE, PROVIDENCE, R.I., JAN 1939	
SUBMITTED:	APPROVED:
HEAD, DESIGN SECTION:	CHIEF, ENGINEERING:
DESIGNED:	FILE NO. CT 1234
ASSOC. ENGINEER:	ENGINEER:

KEY	DATE	REVISION	INDICATED BY	DESIGNED BY	CHECKED BY	APPROVED BY
1-13-41		Spillway elevation raised				
10/27/39		Piers and channel walls extended				





UNITS REQUIRED FOR COMPLETE INSTALLATION	
NO	DESCRIPTION
3	Conduit Linings - Service Gate
3	Conduit Linings - Emergency Gate
3	Service Gates
1	Emergency Gate
3	Stationary Hoists
3	Sets Service Gate Guides
3	Sets Emergency Gate Guides
3	Service Gate Frames
3	Emergency Gate Frames
3	Service Gate Frame Extensions
3	Sets Service Gate Guard Angles
3	Sets Emergency Gate Guard Angles
1	Lifting Beam
3	Emergency Gate Frame Extension



### SECTION B-B

Section taken with gates removed  
SCALE: 1/2" = 1'-0"

### NOTES

- Furnishing and installing gates and accessories complete paid for at contract price under Item No. 34.
- For details of conduit lining see Sheets No. 59 to 61 inclusive.
- Traveling crane paid for under Item No. 35.
- Emergency gate guides to stop 4" below operating floor elevation.
- Service gate guides to stop 4" below basement floor elevation.
- Guard angles on upstream face of emergency gate well to extend to El. 524.0.
- Guard angles on upstream face of service gate well to extend to El. 516.3.
- For support of emergency gate guides above the basement floor see Sheet No. 21.

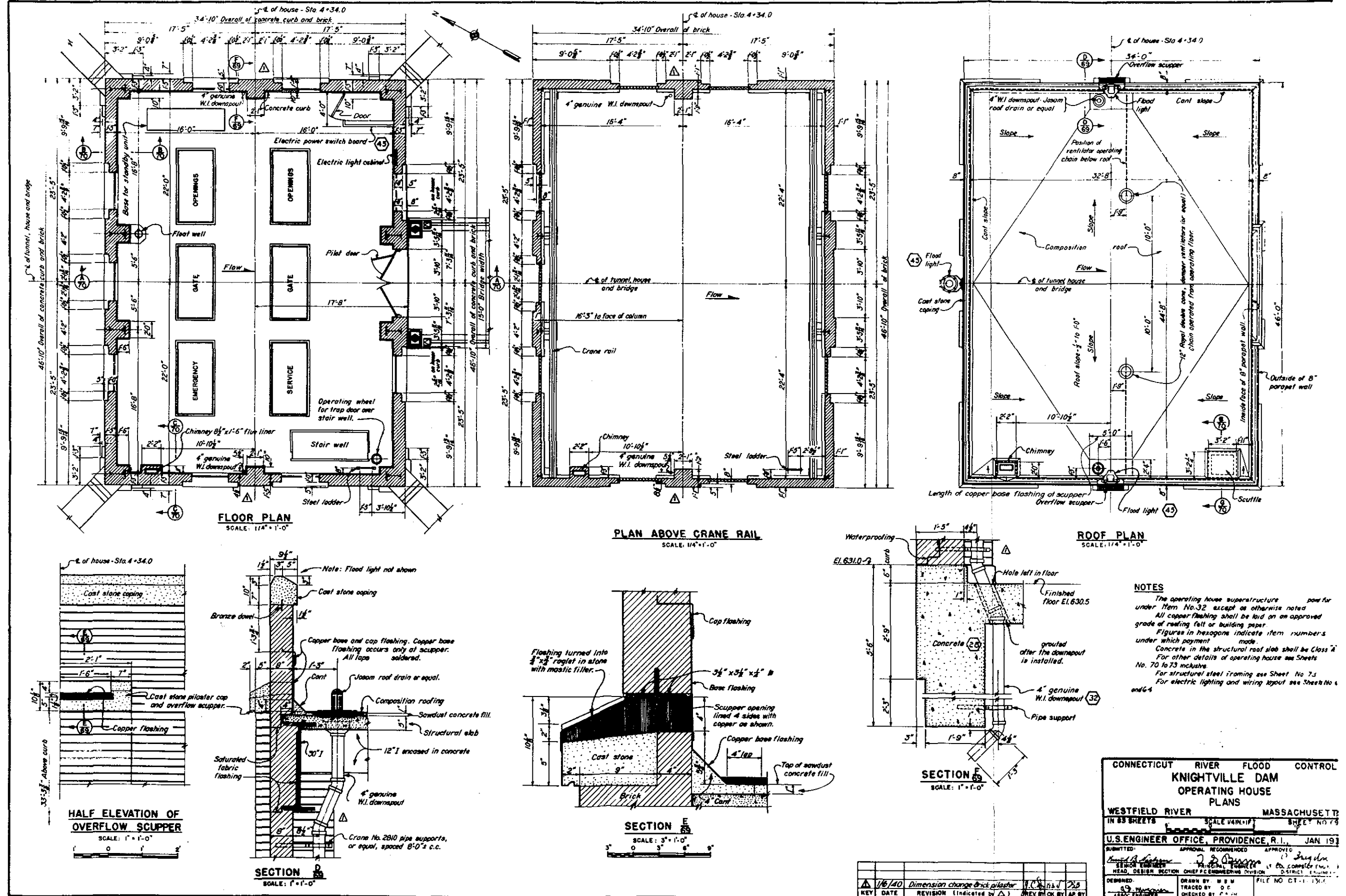
CONNECTICUT RIVER FLOOD CONTROL  
**KNIGHTVILLE DAM**  
GATES AND ACCESSORIES  
GENERAL ARRANGEMENT  
WESTFIELD RIVER, MASSACHUSETTS  
IN 83 SHEETS SCALE 1/2" = 1'-0" SHEET NO. 58

U.S. ENGINEER OFFICE, PROVIDENCE, R.I. JAN 191

SUBMITTED: [Signature]  
APPROVED: [Signature]  
HEAD DESIGN SECTION: [Signature]  
DESIGNED: [Signature]  
CHECKED BY: [Signature]  
FILE NO. 11-244

KEY	DATE	REVISION (Indicated by Δ)	REVIEW	OK BY	AP BY
1-13-41		Spillway elevation raised	OLD	NEW	
1-27-49		Piers and walls extended	OLD	NEW	

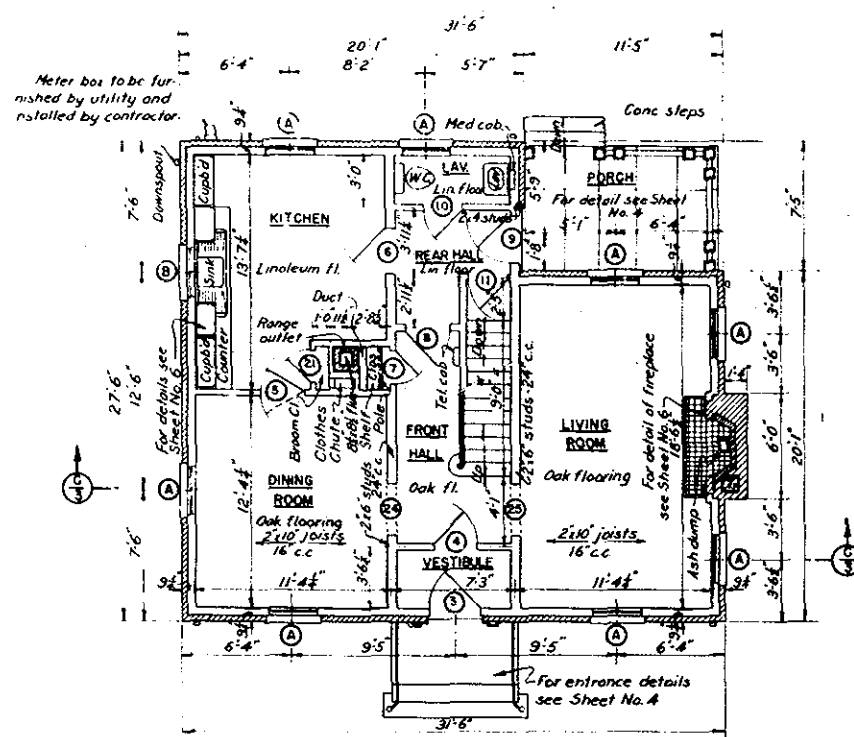




1/16/40	Dimension change brick pilaster	1/16/40	1/16/40	1/16/40
KEY	DATE	REVISION (indicated by Δ)	REV BY	OK BY

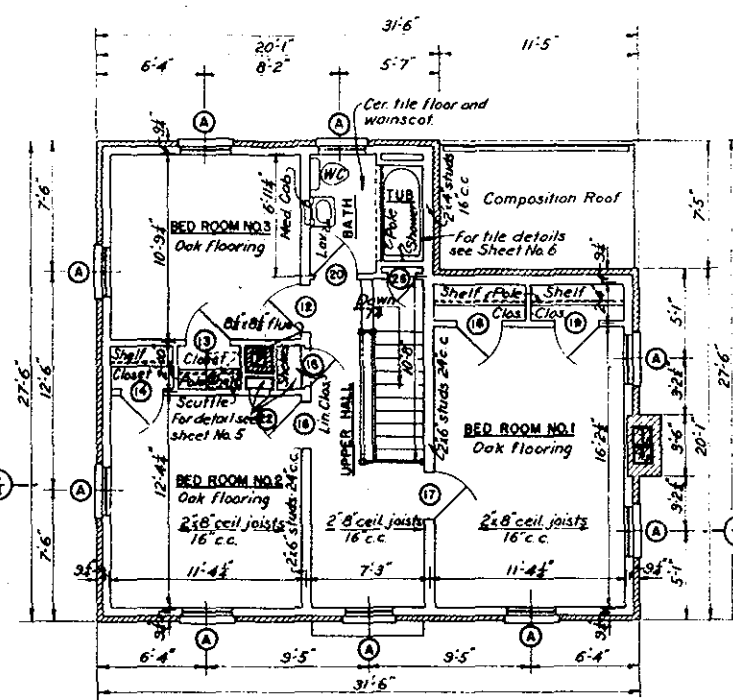
CONNECTICUT RIVER FLOOD CONTROL	
KNIGHTVILLE DAM	
OPERATING HOUSE	
PLANS	
WESTFIELD RIVER	MASSACHUSETTS
IN 83 SHEETS	SHEET NO. 73
U.S. ENGINEER OFFICE, PROVIDENCE, R.I., JAN 1940	
SUBMITTED	APPROVED
DESIGNED	TRACED BY
CHECKED BY	FILE NO. CT-1-134





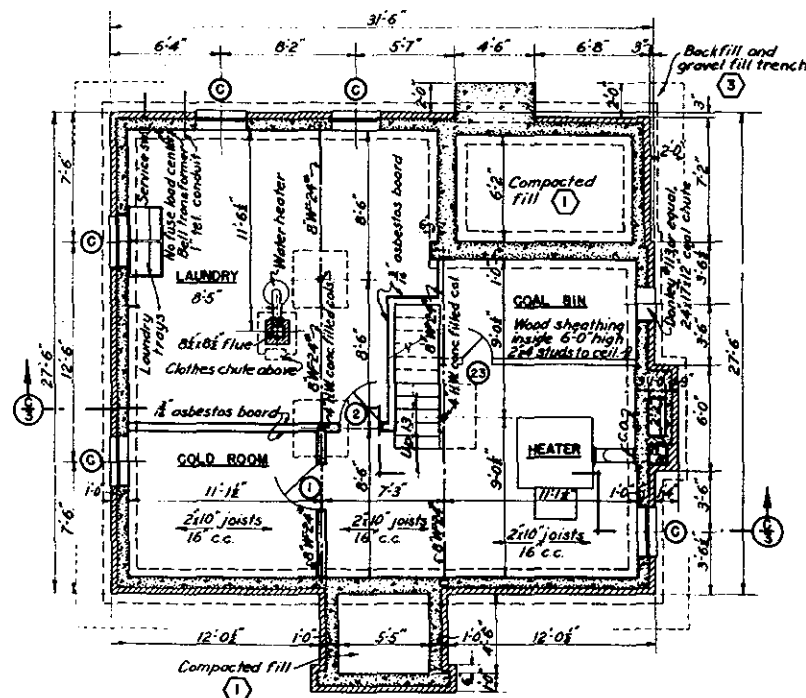
FIRST FLOOR PLAN

SCALE: 1/4" = 1'-0"



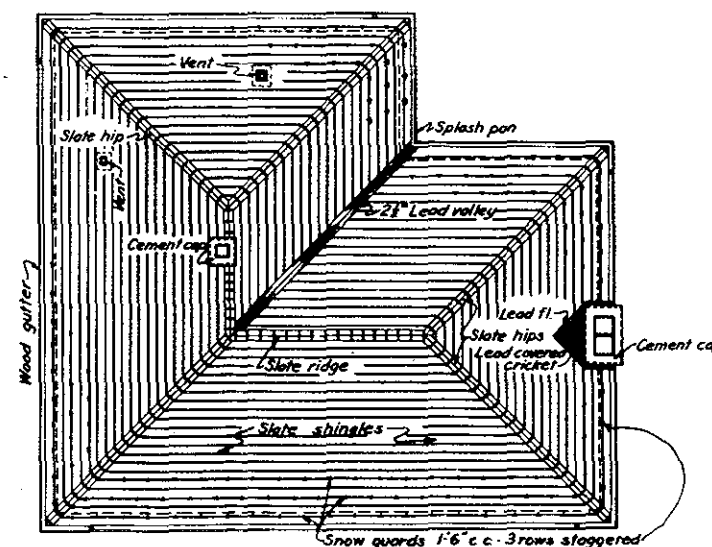
SECOND FLOOR PLAN

SCALE: 1/4" = 1'-0"



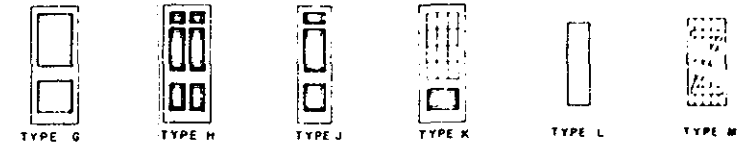
BASEMENT PLAN

SCALE: 1/4" = 1'-0"



ROOF PLAN

SCALE: 1/4" = 1'-0"



DOOR SCHEDULE									
NO.	TYPE	SIZE	CAT. NO.	REMARKS	NO.	TYPE	SIZE	CAT. NO.	REMARKS
1	G	2'-6" x 6'-6"	C-3040		14	H	2'-6" x 6'-6"	C-3020	
2	G	2'-6" x 6'-6"	C-3040		15	J	2'-0" x 6'-0"	C-3020	See linen closet detail Sheet No. 5
3	H	3'-0" x 6'-6"	C-1020	Weatherstripped +	16	H	2'-6" x 6'-6"	C-3020	
4	K	3'-0" x 6'-6"	C-1110		17	H	2'-6" x 6'-6"	C-3020	
5	H	2'-6" x 6'-6"	C-3020		18	H	2'-6" x 6'-6"	C-3020	
6	H	2'-6" x 6'-6"	C-3020		19	H	2'-6" x 6'-6"	C-3020	
7	J	2'-0" x 6'-0"	C-3020		20	H	2'-6" x 6'-6"	C-3020	Marble threshold
8	H	2'-6" x 6'-6"	C-3020		21	J	1'-5" x 4'-5"	C-3020	
9	K	2'-6" x 6'-6"	C-1110	Weatherstripped +	22	L	1'-5" x 4'-5"		Plywood, for detail see Sheet No. 5
10	H	2'-6" x 6'-6"	C-3020		23	M	2'-3" x 15'-0"		Bottom of 9" above floor
11	H	2'-6" x 6'-6"	C-3020		24		3'-0" x 6'-6"		Wood trimmed opening
12	H	2'-6" x 6'-6"	C-3020		25		3'-0" x 6'-6"		Wood trimmed opening
13	H	2'-6" x 6'-6"	C-3020		26	L	1'-6" x 4'-0"		Plywood, for detail see Sheet No. 5

\* Chamberlin No. 800 or equal

HARDWARE SCHEDULE									
ITEM	CAT. NO.	PAGE	LOCATION (DOOR NO.)	FINISH QUANTITY	ITEM	CAT. NO.	PAGE	LOCATION (DOOR NO.)	FINISH QUANTITY
Lock	1248M	269	9, Master key	F-10 1	Door knob	2383	221	3, 7, 10, 13, 14, 15, 18, 19, 20, 21	F-10 1, ea door
Lock	223	292	10, 20	F-24 1, ea door	Door knob	2383	221	10, 20 (inside of room)	F-24 1, ea door
Latch	026	311	1, 2, 4, 6, 7, 8, 13, 14, 15, 16, 19, 21	F-10 1, ea door	Knocker	21	507	3	F-10 1
Lock	734	208	11, 12, 15, 17	F-10 1, ea door	Spindle	40	234	3, 15, 21	Natural 1
Lock	1213M	278	3, Master key	F-10 1	Spindle	20	234	1, 2, 4, 6, 8, 9, 10, 12, 16, 17, 20	Natural 1, ea door
Flotation catch	12	449	22, 26	F-10 1	Spindle	59	233	7, 13, 14, 18, 19	Natural 1, ea door
Door stop	203	541	20, on door	F-24 1	Key plate	925	231	11, 12, 16, 17	F-10 2, ea door
Door stop	203	541	1, 2, 3, 4, 5, 11, 12, 14, 17, 18, 19	F-10 1, ea door	Push button	97	367	3, 9	F-10 1, ea door
Butts	38-80	436	3, 9	F-10 1/2 pair ea door	Push plate	1015	525	5	F-10 2
Butts	38-80	436	1, 2, 4, 6, 7, 8, 10, 12, 13, 14, 15, 16, 17, 18, 19, 21	F-10 1 pair ea door	Seah	120	482	1 for each window	F-10 18
Butts	38-80	436	20	F-24 1 pair	Seah lift	080	514	2 for each window	F-10 36
Butts	1072	446	22, 26	F-10 1 pair ea door	Stop head screw and washer	120	540	6 for each window	F-10 96
Floor hinge	12	494	5	F-10 1 set				Both and lavatory	F-24 12
Door handle	420	191	3	F-10 1	Cool hooks	139	503	Located as directed in field	F-10 40
Door knob	2383	221	1, 2, 4, 6, 8, 9, 11, 12, 16, 17	F-10 2, ea door	Cool hooks	055	503	10, 20,	F-24 1, ea door

All items listed above refer to Russell & Erwin Mfg. Co., New Britain, Conn., Catalogue #16, or equal.  
All items listed below refer to Stanley Works, New Britain, Conn., Catalogue #61, or equal.  
Provide a general master key for doors No. 3 and 9, and Utility House door No. 32.

MISCELLANEOUS EQUIPMENT			
ITEM	QTY	SIZE	LOCATION
Cleanout	2	8" x 8"	Boiler and kitchen flues
Doors	1	10' x 12'	Fireplace flue
Ash dump	1	7' x 10'	No. 70 - See Sheet No. 6
Damper	1	36"	Fireplace - Poker control

NOTES:  
All items on this sheet will be paid for under Item No. 1, unless otherwise noted.  
All numbers on finish woodwork refer to catalogue numbers of Curtis Cos. Inc., of Clinton, Iowa, or equal.  
For electrical circuits, see Sheet No. 7.

THIS SHEET HAS BEEN TRACED FROM ORIGINAL SIGNED SHEET IN DISTRICT OFFICE FILES.

CONNECTICUT RIVER FLOOD CONTROL  
KNIGHTVILLE DAM  
OPERATOR'S QUARTERS  
PLANS AND SCHEDULES  
WESTFIELD RIVER MASSACHUSETTS

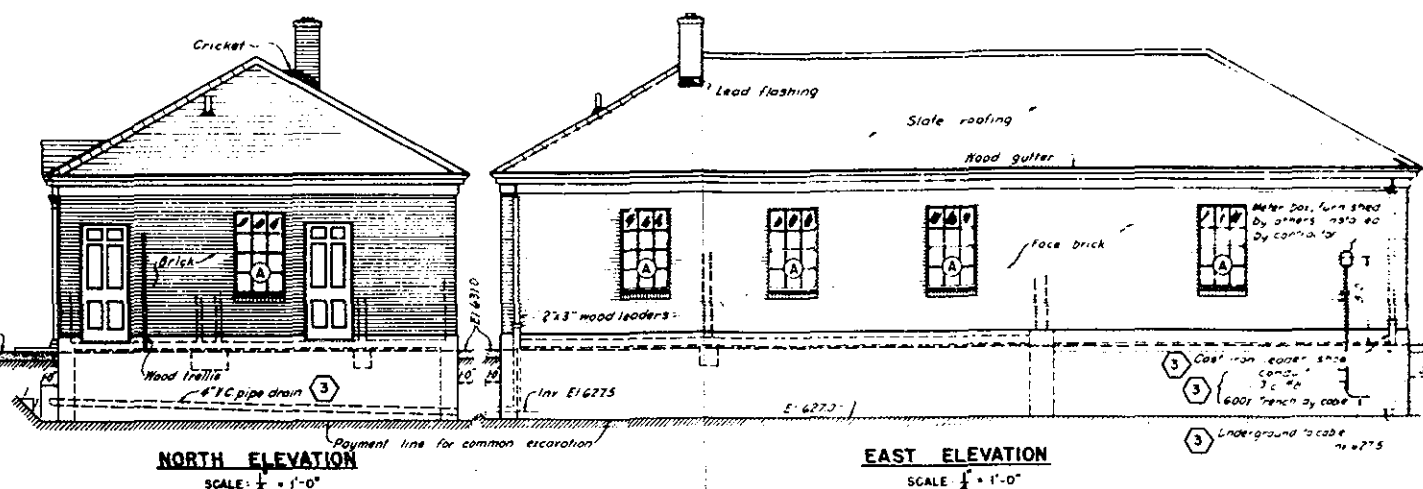
IN 9 SHEETS SCALE: 1/4" = 1'-0" SHEET NO. 2

U.S. ENGINEER OFFICE, PROVIDENCE, R.I., DEC. 1941

SUBMITTED APPROVAL RECOMMENDED APPROVED

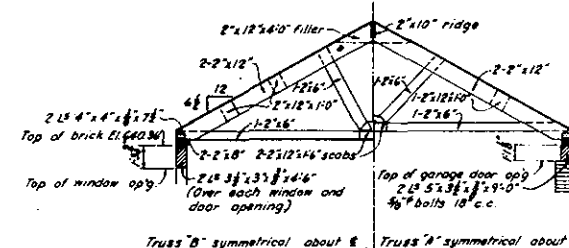
J. C. Dingwell T. S. Burns H. S. Bishop, Jr.  
ENGINEER ENGINEER PRINCIPAL ENGINEER  
HEAD, DESIGN SECTION CHIEF, ENGINEERING DIV. CHIEF, ENGINEERING DIV.

DESIGN SECTION DRAWN BY E. M. Viner TRACED BY E. M. Viner CHECKED BY E. M. Viner FILE NO. CT-1-1567

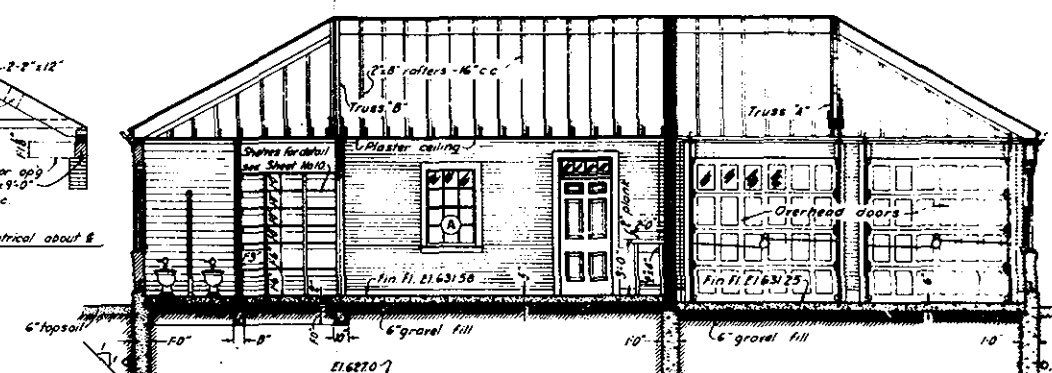


NORTH ELEVATION

SCALE:  $\frac{1}{4}'' = 1' - 0''$

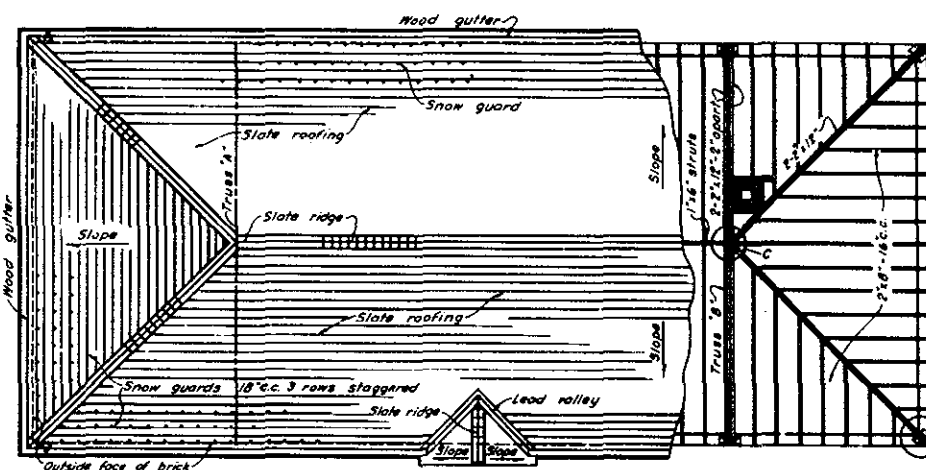


Truss "B" symmetrical about  $\bar{x}$       Truss "A" symmetrical about  $\bar{x}$



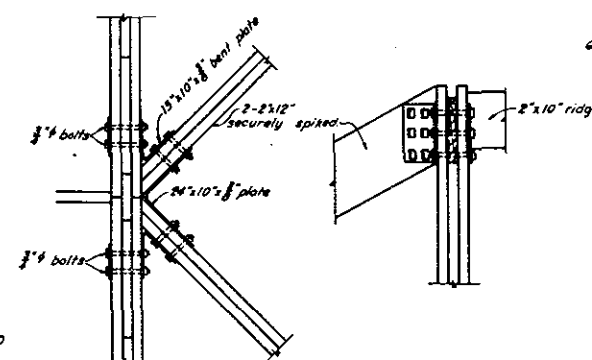
## SECTION I

SCALE: 1" = 10'



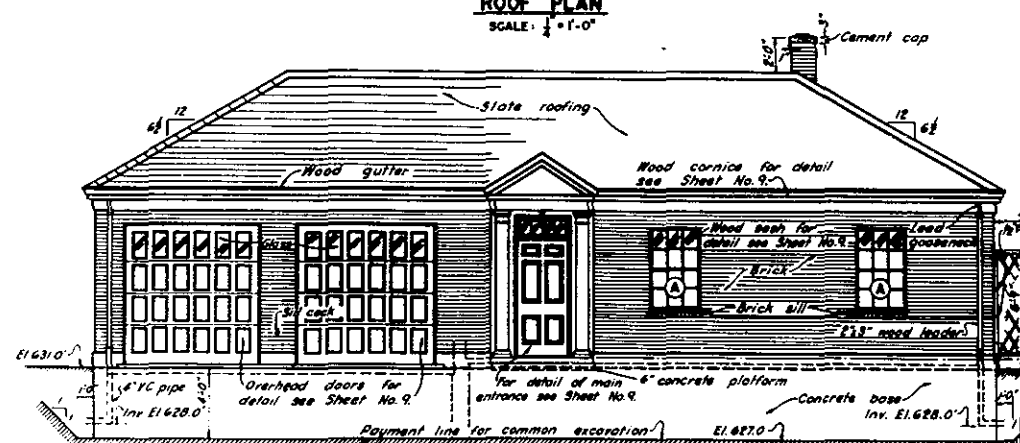
DETAIL AT "C"

SCALE: 1" = 1'-0"



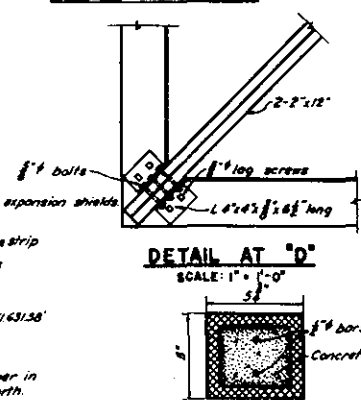
DETAIL AT "C"

SCALE: 1" = 1'-0"



**FRONT ELEVATION**

SCALE: 1/4" = 1'-0"



DETAIL AT 'D'

SCALE: 1" = 1'-0"



### DETAIL OF HOLLOW TILE INTERIOR LINTELS

SCALE: 3" = 1'-0"

FINISH SCHEDULE	
Paint as manufactured by Sherwin-Williams Co. of Cleveland, Ohio, or equal.	
Interior woodwork	- Flat Ivory
Ceilings	- Flat White
Exterior woodwork	- Outside Flat Ivory
Both sides of Overhead Doors	- Outside Flat Ivory

HARDWARE SCHEDULE					
Hardware as manufactured by Russell & Erwin Mfg. of New Britain, Conn. (Catalogue No.), or equal.					
ITEM	CATA. NO.	PAGE	LOCATION	FINISH	QUANTITY
Lock	11248B	269	Door 32	F10	1
Locks	11248	269	Doors 33,34,35,36,37	F10	1 for each door
Bolts	B0 - 4" x 4	435	Doors 36,35,34,35,36,37	F10	1 pair for each door
Door stops	203	541	Doors 32,33,36,37	F10	1 for each door
Knobs	2303/Noon B	221	Doors 32,33,34,35,36,37	F10	2 for each door
Spindles	20	234	Doors 36,35,34,35,36,37	F10	1 for each door
Smash fasteners	180	482	Windows "A"	F10	8
Smash fits	080	514	Windows "A"	F10	8 pair
Stop head screws	180	540	Windows "A"	F10	48
Smash puller	Sc7000	168	Windows "A"	F10	16 pair
Call panels			Doors 33,34		1 each door

Note: Doors No.38 and 39 are sectional, vertical sliding doors as manufactured by the Overhead Door Co., Hartford City, Indiana, or equal.  
These doors are to be furnished and installed complete with all necessary hardware and locks. Upper panel glazed with wire glass.  
Provide a general master key for Door No.32 and Operator's Quarters. Doors No.3 and 4.

### NOTE

*For general notes see Sheet No 9*

THIS SHEET HAS BEEN TRACED FROM ORIGINAL  
SIGNED SHEET IN DISTRICT OFFICE FILES

CONNECTICUT RIVER FLOOD CONTROL  
KNIGHTVILLE DAM  
GARAGE AND UTILITY BUILDING  
FLOOR PLANS, ELEVATIONS, AND SECTIONS  
WESTFIELD RIVER MASSACHUSETTS

IN 9 SHEETS SCALE 1/4"=1 FT SHEET NO 8

U.S. ENGINEER OFFICE, PROVIDENCE, R.I., DEC 1941

SUBMITTED J. G. Dingwall APPROVAL RECOMMENDED T. S. Burns APPROVAL H. S. Bishop Jr

SENIOR ENGINEER		PRINCIPAL ENGINEER	
HEAD, DESIGN SECTION		CHIEF, P.C. ENGINEERING DIV.	
DESIGN SECTION	DESIGN J.B. - B.W.		

<u>E. M. Viner</u> ENGINEER	TRACED J.B. CHECKED B.M.D.	FILE NO C7 1 1074
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